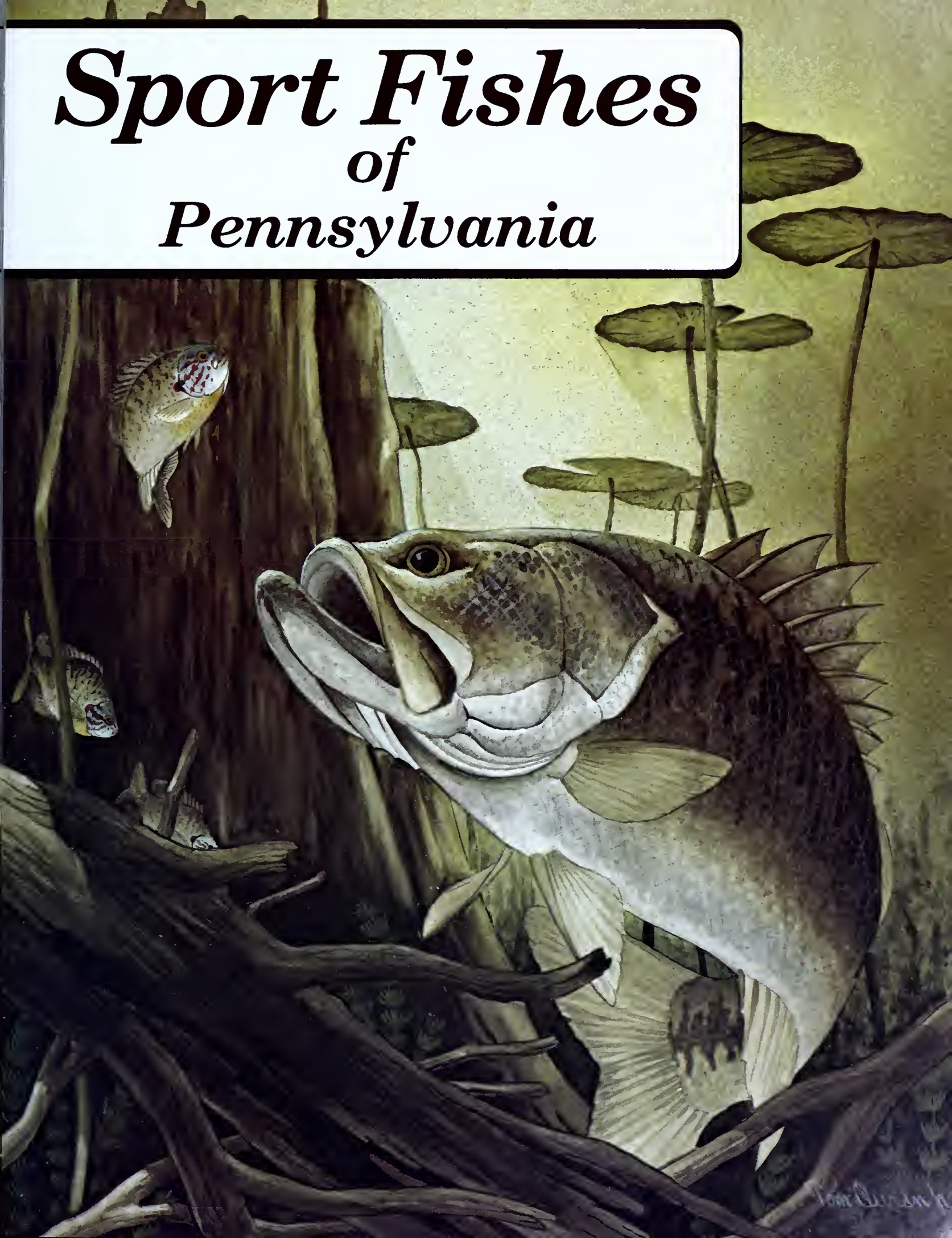
SPORT FISHES OF PENNSYLVANIA

Larry L. Shaffer

Sport Fishes of Pennsylvania



Yellow Perch

Sport Fishes of Pennsylvania

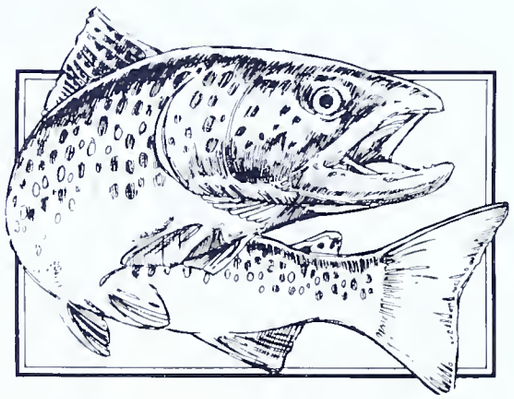
"Pennsylvania's Official State Fish"

The Brook Trout

Sport Fishes of Pennsylvania

by

Larry L. Shaffer



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Man must go back to nature for information . . .

Thomas Paine

PREFACE

This publication, while not meant to be a scientific journal, does present material of a technical nature about Pennsylvania fishes. Our intent was to reduce the scientific jargon, eliminating the technical terms and fancy names, so that anyone who wants to, could learn a little more about the broad range of fishes most common in the state. It is for anglers and non-anglers alike who have an interest in — or, for whatever the reason, the need to know more about — Pennsylvania's sport fishes.

While we made every attempt to be as accurate as possible, it should be noted that in certain areas we may have taken liberties in not providing absolutely or specifically all the information about certain species. To do so, and still maintain a brief, easy-to-understand, non-scientific review of each fish, would have been impractical and possibly even more confusing to the reader. Our aim was to provide sufficient information so that the reader would have a basic understanding of each species, be better equipped to correctly identify each, and in general, come away with a feeling that he is a little more familiar with at least one segment of our vast aquatic natural resources. To that end, we hope we have succeeded.

And now a word of caution. While we have described the various colors and patterns that make each fish a little more distinctive, we should point out that these features can vary with habitat, available food, time of the year and other factors. Thus, unlike some other animals (birds, for instance) comparing colors and patterns is not necessarily a good method to use in identifying a particular species. It is for this reason we have attempted to provide other physical features that are more reliable in sorting out one fish from another. In some instances, even this can become difficult, because in certain cases, laboratory dissection is the only reliable method. But again, for our purposes here, the information presented should be sufficient to fulfill most needs. The various physical features described in this booklet refer to adults rather than juveniles, except where otherwise noted.

We would be remiss if we did not extend special thanks to Martin Marcinko and Rickalon Hoopes, Pennsylvania Fish Commission, Fishery Management Section, and to Richard St. Pierre of the United States Fish and Wildlife Service, Department of the Interior. Their technical expertise and efforts in reviewing this manuscript helped keep us on the right track and is sincerely appreciated.

L.L.S.

Introduction

There are few of us living in Pennsylvania who have not seen first-hand its diverse geographical features. A trip across the Keystone State, North to South, East to West, makes evident a varied topography that directly or indirectly affects the fish fauna we find in our equally diverse waters.

Several fish still swimming in our waters today can trace their roots back millions of years. Their evolvement and that of others, has been affected to a large degree by the awesome changes that took place over a period of millions of years as the earth settled into its present form. The huge glacial movements that descended into much of the northern part of Pennsylvania were responsible for creating in some cases, altering in others, an environment that would support a diverse population base of aquatic animals. The glaciers, scraping, grinding, pushing and shoving, changed the course of huge rivers forever. These massive piles of ice closed off some waterways, opened others and created new ones where before none existed.

Other factors have had an impact on the development, distribution, varieties and numbers of fishes now residing in Pennsylvania waters. We're in a zone that permits us to enjoy cold, cool and warm water temperatures. In addition, types of water are directly affected by the diverse physical features of the state. Differing water temperatures permitted a more varied form of fish life, while physical features presented natural boundaries in separating and restricting various species to certain parts of the state.

With some 42,000 miles of streams and rivers and hundreds of lakes, representing all sorts of aquatic environments, Pennsylvania is home to a large number

of different species or families of fishes. Fishery biologists have identified more than 150 species representing some two dozen different families. Some are represented by only one member, the bowfin for instance. Like the sunfish family, others are more numerous. In this book, we've discussed only about one-third of these fish. We've concentrated for the most part on those considered important sport fishes, although there are some exceptions. The sculpin, normally considered a coldwater baitfish, was included because of its close association with trout and trout habitat. The shortnose sturgeon, an endangered species, was included with migratory fishes since it at one time was more plentiful and still is recorded on occasion in the Delaware River.

Fish, like any other animal, have their own peculiarities, and we've attempted to cover some of them. Feeding habits vary from species to species, some scanning the bottom searching for anything edible. Others, referred to as forage fish, thrive on plankton and plant matter, while crappies, perch and a few others are considered insectivorous, feeding on small animal life. The top of the food chain, the predacious fishes such as the walleye and pike family, prey on all the others, nature's way of keeping things in balance.

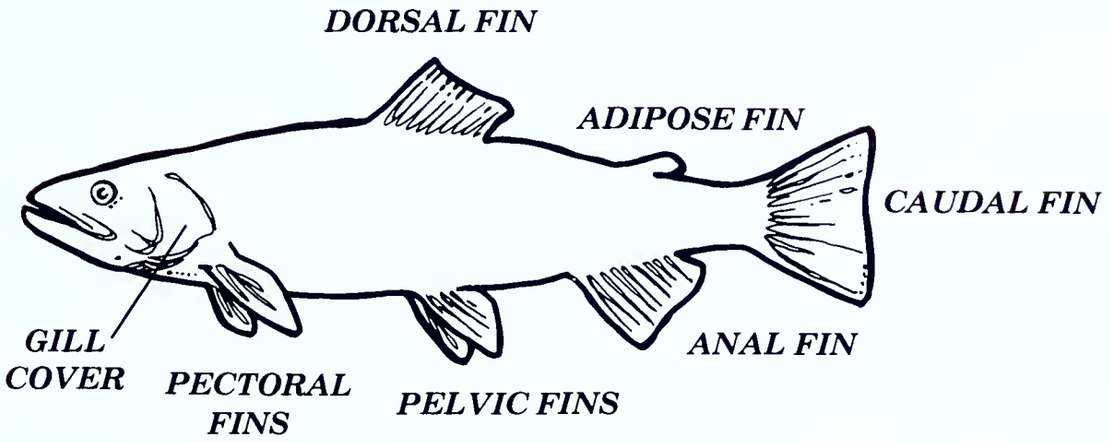
Some species are diurnal, most active during the day when taste and sight are used most for obtaining food. Others are nocturnal and have developed a keen sense of smell and taste in order to locate food.

Among fish, spawning habits vary quite a bit, too. Random spawners which provide no care for their eggs or young, normally lay a great number of eggs but suffer high mortality. Others, which prepare nests and provide security over them, deposit fewer numbers of eggs and experience a better survival rate.

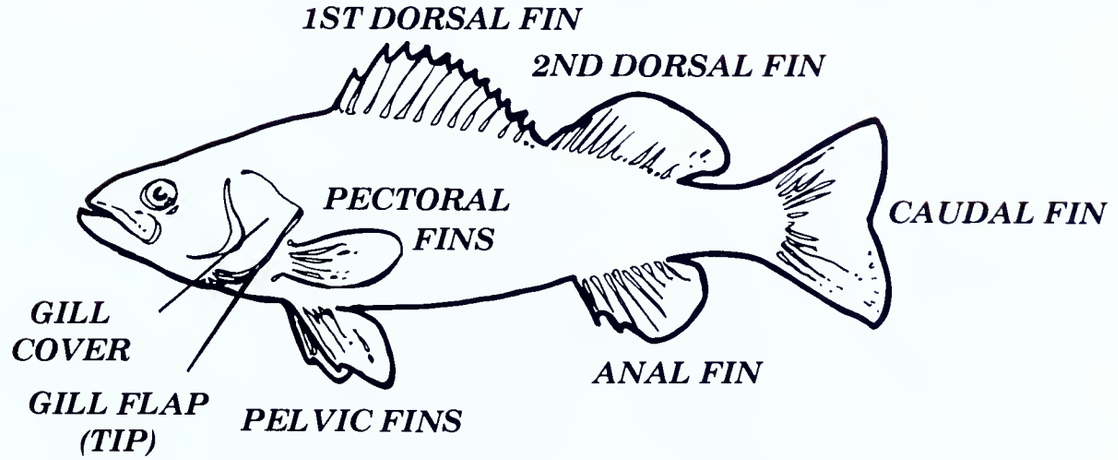
Fish are basically divided into two distinct external body structures, biologically referred to as the study of morphology. They are loosely identified as "Soft-rayed" and "Spiny-rayed" and are illustrated below. The text will often refer to several structural aspects as aids in identifying one species from another.

The sport fishes of Pennsylvania, like all the others, make up an important link in the overall ecology of our aquatic resources. To understand more about these fish is to understand more about ourselves and our environment.

FEATURES OF A SOFT-RAYED FISH



FEATURES OF A SPINY-RAYED FISH



Coldwater Species

Brook Trout
Salvelinus fontinalis

1. Pennsylvania's official state fish, the brook trout, is the only trout native to Pennsylvania, except perhaps for the lake trout. Based on historical records, it's believed the lake trout may originally have been found in an area of Susquehanna County. Although a member of the salmonid family, as are the brown and rainbow trout, the brook trout is more closely related to the Arctic char and dolly varden. Like its cousins, the brook trout is a very colorful creature, considered by many to be the most beautiful of all our fishes. Its back is a dark olive green mottled with darker vermiculations that extend to the tail. Its sides and belly shade to a lighter color; the belly becomes a brilliant orange in the males, especially at spawning time. There usually are red spots with blue halos to accent the body. The leading edges of the pink or reddish lower fins are margined in white, an important identifying characteristic. The tail, or caudal fin, of this scrappy fighter may be slightly forked, but more often than not, is more squarish, hence its oft-used nickname "squaretail".

Originally found throughout most of the state, siltation, destruction of its habitat and an expanding human population have taken their toll of native brook trout populations. Now, except for several meadow limestone streams, this char is found primarily in cold, mountain spring-fed streams where it spawns from mid-September to December. The female prepares a pit in the gravel stream bottom into which the eggs are deposited, fertilized and then covered. The eggs are left to develop over winter, hatching in late winter to early spring. The brook trout feeds on aquatic insects, crustaceans and other fish.

A favorite of anglers, the brook trout is also considered by many people to be one of our most palatable fish.

Brown Trout
Salmo trutta

2. The brown trout now is widely distributed across Pennsylvania, but that wasn't always the case. It was first introduced from its native Europe late in the nineteenth century. And while the brownie is found throughout most of the old continent, the eggs originally brought to Pennsylvania came from Germany. A second strain that was introduced later came from Lock Leven, Scotland, but it is difficult to distinguish between the two varieties. The brown trout is perhaps the most successfully stocked trout in the state with good holdover in many streams.

True to its name, the brown trout is a golden brown above, shading to a lighter tone on the sides and silver or dusky yellow below. Large dark spots outlined with pale halos mark its sides, back and dorsal fin. Quite often, reddish-orange or yellow spots also dot the lateral surface. The fins are yellowish brown.

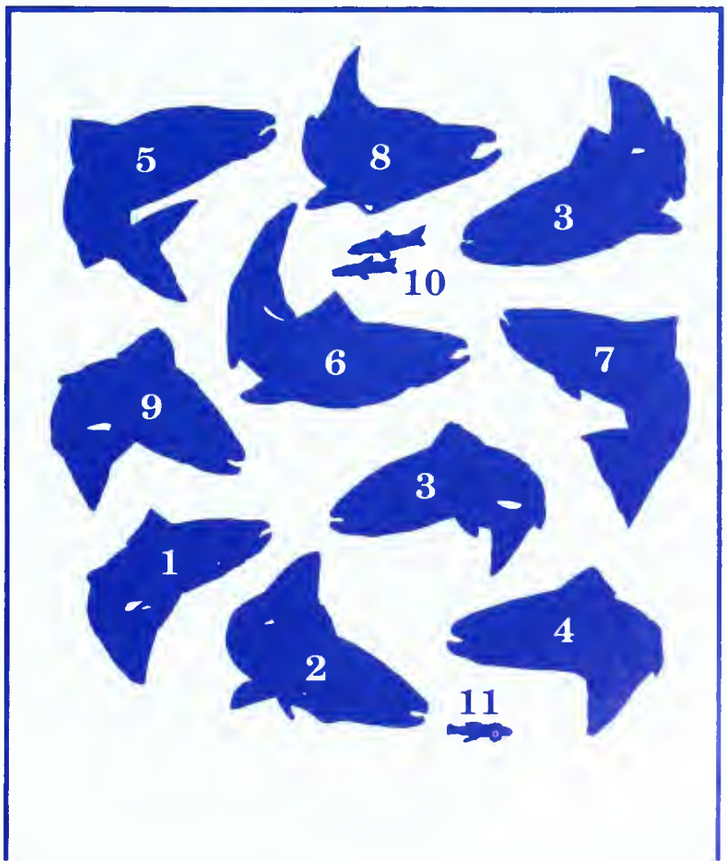
The brown trout is able to tolerate water temperatures slightly higher than the brook trout. It also grows to a larger size and lives longer than the brook or rainbow. It is probably the most difficult of the trout to catch, and perhaps that too, accounts for its reaching larger sizes. A brownie of one pound or so is common, over ten pounds considered exceptional.

The brown trout has adapted well in Pennsylvania with natural reproduction occurring in quite a few of our waters. The brown trout spawns in the fall, starting slightly earlier than the brook trout, depositing its eggs in a gravel pocket the female has prepared, preferably near an area fed by springs. Hatching takes place during the following spring months. No care is given to the eggs or young and they are left to fend for themselves.

The brown trout feeds on aquatic and terrestrial insects, crayfish and other crustaceans and perhaps more fish than the brook or rainbow. They are active at night, and it's then that anglers often score well, catching large brownies especially during the summer months.

Rainbow Trout — Steelhead
Salmo gairdneri

3. Native to the Pacific slope from California north to Alaska, the rainbow trout now is widely stocked throughout Pennsylvania. Natural reproduction in our eastern streams, however, has not been as successful as with the brown trout. The rainbow trout is considered



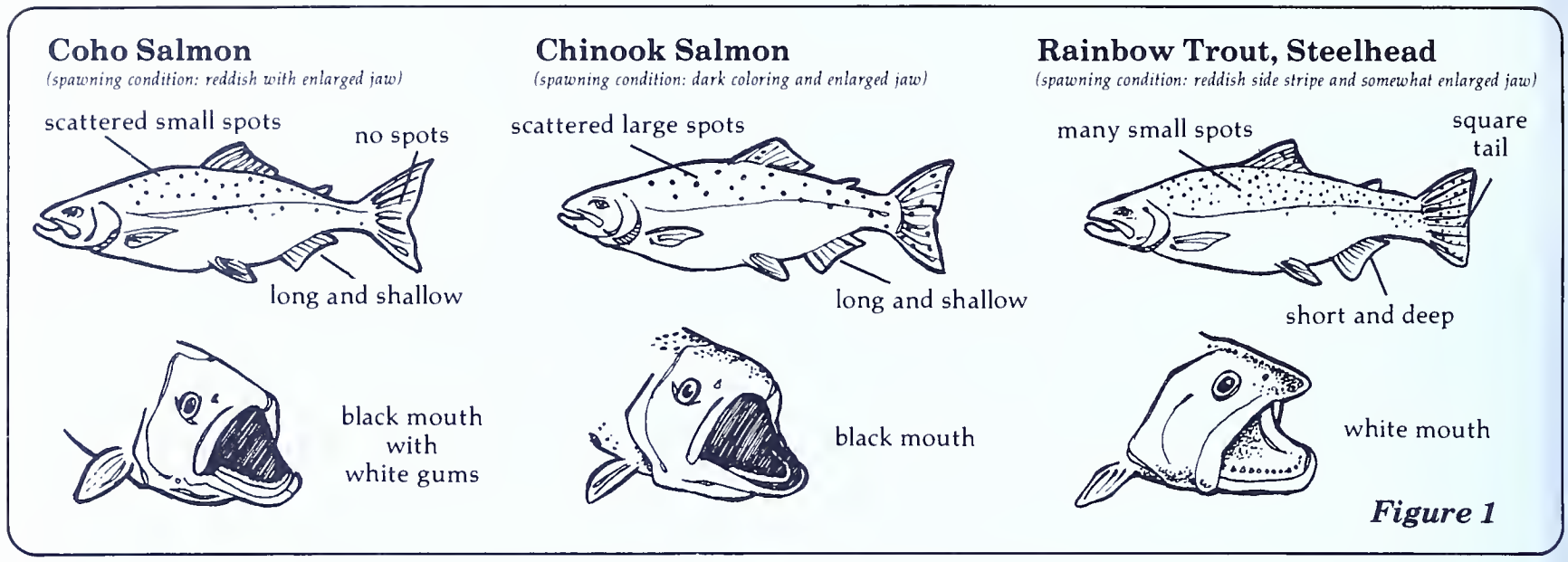


Figure 1

a fast-water fish, preferring swift runs and riffle areas of larger streams. Of all the trout, it is probably the most agile fighter, breaking water and displaying a wide array of acrobatic maneuvers.

The rainbow is a silver gray to dark greenish in color with the familiar pinkish or reddish streak along the lateral line reflecting light into a rainbow of colors. The caudal fin contains rows of dark spots, and small spots cover the head, sides and belly. In the wild, spawning males become deeply colored.

Natural reproduction of the rainbow occurs in the spring, unlike the other fall-spawning species of trout and salmon. March and April bring spawning activity on gravel beds washed over by a good current. The female prepares the redd, but after depositing and fertilizing of the eggs is completed, no further care is given and the parent rainbows go about business as usual.

This transplanted Westerner is the same species as the steelhead, a name commonly given to the rainbow which migrates to the sea or a large lake during part of its life and returns to its native stream to spawn. The rainbow and the steelhead differ only slightly in color. The steelhead remains more silvery, the pinkish lateral stripe less obvious than on the rainbow. In Pennsylvania, steelhead in Lake Erie grow to a larger size than most rainbows. It is often said, however, that the steelhead tends to be somewhat slimmer than the non-migratory rainbow. The number of rays in the anal fin can be used as an aid in separating a steelhead from the coho or chinook salmon. The steelhead will have eight to 12 rays, while the salmon have from 12 to 19 rays in the anal fin. For further identifying characteristics, see *Figure One.*

Lake Erie steelhead present a new and exciting challenge to anglers and often are caught during the fall salmon run. Even better steelhead fishing occurs in late winter and early spring when these huge silvery fish fight their way up Erie County tributary streams.

The food of the rainbow consists mainly of aquatic insects, crustaceans and to a lesser degree, fish. It feeds extensively on the surface of the water.

Palomino
(hybrid)

4.Here's a model that might come under the heading "novelty craft". Might, we say, because here also, is a fish that comes under the heading "fighter." The palomino is a strain of rainbow first introduced to Pennsylvania anglers in 1967. And it carries all the sporting characteristics of the rainbow with it, and then some. It's a gamey high jumper that is perhaps more vigorous and a bit stronger than the normal rainbow. The palomino is a hybrid of the rainbow trout and the West Virginia golden trout. It is lighter in color than the normal rainbow, but darker than the pure strain of golden trout.

The golden trout is a rich dark golden color with the traditional rainbow stripe. It was popularized in 1963 as the West Virginia Centennial Golden Trout, and was perfected from a single female in 1954 found to be colored a mosaic of gold but with the normal pigment of the rainbow. Selective breeding from that point on produced the pure strain of golden trout.

The next step to producing the palomino was a series of hybridizing studies done by Fish Commission biologists and researchers at Penn State University. Subsequent crossbreeding between the pure strain of golden trout and the rainbow trout produced what we now know as the palomino trout. Its namesake, obviously, is the similarly colored palomino horse.

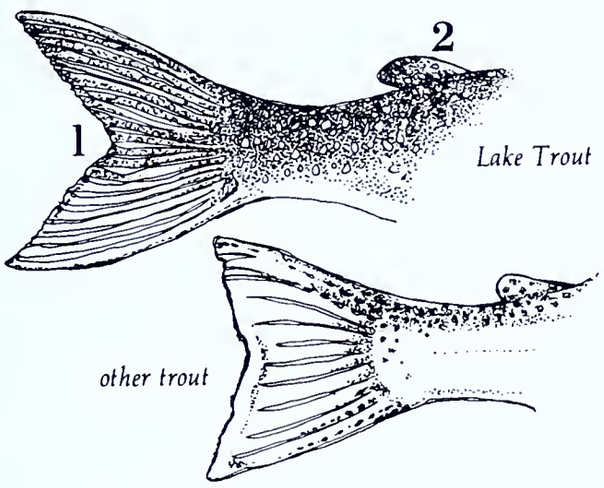
The palomino prefers the same type of habitat as the rainbow. Its feeding habits also parallel its multi-colored parent. It may, however, grow to a larger size at a given age than the normal rainbow. This trait, though, is not all that unusual for a hybrid species.

The palomino trout continues to be produced by the Fish Commission and creates excitement among anglers wherever it is stocked. It often can be seen flashing across the bottom of a clear, deep pool in trout streams throughout the state.

Lake Trout
Salvelinus namaycush

5.The lake trout is a fish of deep, cold lakes, and is found only in a limited number of lakes in Pennsylvania. Actually a char, it is a near relative to the brook trout, but lives longer and grows larger. Lake trout have been known to live for 20 years or more. It is our biggest, but most infrequently caught, trout.

The lake trout is a bright gray, often olive tone in color, shading to a silvery-white on the belly. It is profusely covered with large light-colored spots. Dark



The tail of the lake trout (1) is deeply forked, unlike any others of the trout or salmon in Pennsylvania. The small, fleshy adipose fin (2) is peculiar to the salmon and catfish families.

vermiculations pattern the back and dorsal fin, extending into the tail. A distinguishing characteristic from other trout is the deeply forked tail of the lake trout.

Lake trout, sexually mature at six to seven years of age, spawn at night during the fall months. They prefer depths of 40 feet or less, where they deposit their eggs over a boulder or rubble bottom, allowing them to settle among the narrow spaces between the rocks. They normally do not run up tributary streams to spawn. Little or no preparation precedes the spawning ritual, and the eggs are not guarded during the incubation period which takes until the following spring months to complete. Interestingly enough, the bullhead catfish target on the eggs of the lake trout and may be a contributing factor to their somewhat limited numbers.

Lake trout feed in a manner similar to other trout, their main diet consisting of fish; sculpins appear to be a favorite prey. Since the lake trout inhabits the cold, deep part of lakes in summer, trolling very deep is the only way to expect to harvest one of these spectacular fish. As the water cools, however, lake trout will take flies and other artificial lures near shore.

Coho

Oncorhynchus kisutch

6.The coho salmon, also called the silver salmon, was the first of the Pacific salmon to be transplanted and stocked in any of the Great Lakes. The original range of the coho stretches from California to Alaska, where it runs from the Pacific Ocean into numerous rivers to spawn. Today, Pennsylvania's 42 miles of shoreline bordering Lake Erie provides anglers in this state the opportunity to fish for this spectacular fighter. The Pennsylvania Fish Commission has a regular stocking program that releases large numbers of coho smolts (young salmon, five to seven inches in length) to migrate down tributary streams to live their adult life in the big lake.

The coho is considered one of the smaller salmon in its native habitat, reaching a length of about two feet and weighing eight pounds. The coho enjoys a fast growth rate in Lake Erie where it often tops ten pounds. The coho is bluish above, silvery below with black spots across the back. The spots appear on only the upper lobe of the tail. Sometimes difficult to distinguish from the chinook and steelhead, the coho has a mouth and tongue that are black and a gumline that is light gray to almost white (see *Figure One*). The rays in the anal fin number 12 to 17 compared to the steelhead's 12 or less, another important identifying characteristic.

The coho spawns in the fall, following the earlier-spawning chinook up tributary streams. The migratory run brings in a large number of fish, all destined by nature to die at sexual maturity. Most of the spawning in Pennsylvania is done in the hatchery. After hatching, the salmon spends the first 12 to 18 months of life in the tributary streams — or hatchery — where it was born. Thus, it is at the midpoint in its life before it descends the stream and enters the large body of water where it will feed and grow.

At three years of age, the coho is mature and returns to its native stream to begin the cycle all over again. Some individual males may return a year early on a false spawning run. These smaller, immature fish, averaging around 12 inches in length, are called "jacks".

The Lake Erie coho fishery provides an outstanding opportunity for anglers to experience something previously available only on the West Coast. Not only is the coho an excellent game fish, it also provides great table fare. Since the coho feeds primarily on fish (smelt and schools of alewives are an important prey), most lures resembling small fish can be used to take coho.

Chinook

Oncorchynchus tshawytscha

7.The chinook is the largest member of the salmon family, and in Pennsylvania, only the muskellunge reaches a greater size. Also called the king salmon, no other salmon can match it for shear strength and size. The chinook's scientific name aptly describes the appearance of older fish, especially at spawning time. Translating to "he of the hooked snout," its name bears testimony to the hooked upper and lower jaws that give this huge fish an almost ferocious-looking appearance.

Like the coho, the chinook is a native of the Pacific Ocean, and in fact, is found on both sides of the Pacific. It has been introduced to the Great Lakes, including Lake Erie, where the Pennsylvania Fish Commission has released fish for several years in numbers sufficient to sustain an exciting fishery.

The life cycle of the chinook is longer than any of the other Pacific salmon, and it will spend one to five years in Lake Erie before returning to the tributary from which it migrated as a young smolt.

The chinook is silvery below and on its sides, shading to a dusky or bluish color above. Large black spots cover

the back of the chinook as well as its dorsal fin. Unlike the coho, these spots also appear on both the upper and lower lobe of the tail. Compared to the steelhead and coho, the chinook has a black or very dark gray mouth, gumline and tongue (See *Figure One*). Its tail is more forked than commonly seen on trout, including the steelhead. The rays in the anal fin number from 14 to 19 and can be used, in addition to other characteristics mentioned, to help differentiate this fish from the steelhead.

The young salmon will feed on insects, but as adult fish, turn to prey on fish and larger invertebrates found in open water. Its angling value is outstanding. A strong fighter, the chinook will often make great jumps, providing a thrill-a-minute for the angler who catches one. On the table, the chinook is considered fine eating, especially when baked or smoked.

Kokanee

Oncorhynchus nerka kennerlyi

8.This is the freshwater form of the sockeye or red salmon, native to the Pacific Coast from California north to Alaska. In its native range, this smaller member of the salmon family, in spite of its size, runs in those same streams and large rivers as its bigger relatives, the coho and chinook. Just the same, it has adapted well to landlocked lakes. In Pennsylvania, the kokanee is found in only a few deep coldwater lakes and most predominantly in Upper Woods Pond, Wayne County, where possibly some natural reproduction has occurred.

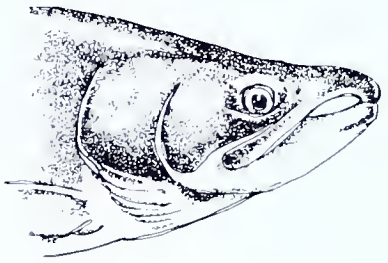
The kokanee is slightly bluish across the back, becoming silver colored on its sides and belly. During the spawning season, the male becomes colored a brilliant red accented with contrasting greens and blacks. He also develops a formidable looking hooked jaw. The female becomes a slate gray during this period.

The kokanee is not a big fish. It usually is mature at eight to 15 inches, which translates to about a half pound in weight. Normal adult size can be a far-ranging eight to 21 inches, depending on habitat and available food. In many respects, the kokanee may resemble our trout in size, color and physical appearance, but one possible identifying characteristic is the number of rays in the anal fin. The kokanee usually will have 11 to 16, whereas the trout will always have fewer than 12 rays in the anal fin.

Like other members of its family, the kokanee spawns in the fall and will die soon after the eggs have been deposited and fertilized. Even the landlocked species usually will attempt to run up small streams where the redd is prepared. The fry will remain in the streams for only a few days after hatching. If spawning is to take place in the lake, the nest is prepared on gravelly shoals. Although its primary diet is plankton, unusual for a member of the trout family, it has been known to eat insects, too.

The kokanee travels in schools as it explores its deep-water home and is thought by many to be difficult to catch. This probably is due to its preferred diet of zooplankton. Anglers have had success, however, trolling, still fishing and flycasting. When landed, the kokanee is usually a three- or four-year-old fish.

The kokanee provides some of the finest eating found anywhere.



The older trout and salmon, especially the males at breeding time, take on a grim-looking appearance with their hooked jaw. Called a kype, the "hook" is comprised of cartilage.

Landlocked Atlantic Salmon

Salmo salar

9.The original range of the Atlantic salmon extends across the Atlantic Ocean between Europe and North America, where it can be found as far south as the Connecticut River. Successfully landlocked in several states, the Atlantic salmon has been stocked in Pennsylvania in Harvey's Lake, Luzerne County. Based on its scientific name, *Salmo,* this particular species is a closer relative to the brown trout than it is to the Pacific salmon.

The Atlantic salmon usually is a brownish color across the back, becoming more or less silvery on the sides and belly. This coloration continues in the landlocked species, although it may become primarily silver throughout the body. Small x-shaped spots dot the sides and back. Characteristic of all members of the trout and salmon family, the landlocked Atlantic salmon has the small fleshy adipose fin located on its back directly in front of the tail.

The Atlantic salmon is anadromous, meaning it migrates from its home in a larger body of water to a small stream to spawn. Although this usually occurs sometime between October and the end of November, the fish may begin to congregate at the mouths of the tributaries in September or even several months prior. Reproduction may occur at either the inlet or outlet of the lake, in streams having swift riffle areas. The female prepares the nest into which the eggs are deposited and covered. No parental care is given to either the eggs or the young which hatch the following spring. The young may stay in the stream for two or three years before journeying back to the lake or other larger water. Unlike the Pacific salmon which dies after spawning, the Atlantic salmon will live to return at least one or two times more to spawn.

The landlocked Atlantic salmon is considered a carnivore (meat eater) and feeds on invertebrates and small fish. Its favorite forage fish is smelt.

American (Rainbow) Smelt

Osmerus mordax

10. The American smelt is a coldwater anadromous fish originally distributed along the North Atlantic Coast.

Now landlocked in several Pennsylvania lakes, the smelt was first introduced to Lake Michigan and from there it spread to the rest of the Great Lakes. It is an abundant species in Lake Erie where it has become an important forage fish for trout, salmon, walleye and several other large game fish. It also is found in Harvey's Lake, Luzerne County, where it serves as prey for the landlocked Atlantic salmon.

The smelt is a small, slender fish. It is somewhat silvery looking, but with coloration that ranges from a pale olive on the back to purple on its sides, before shading to darker blues or violet nearer the belly. The belly itself, is usually white. Equipped with strong jaws and teeth, the mouth of the smelt is large in proportion to the rest of its body. Its tail is strongly forked, and the body is covered with large scales.

The smelt is a spring spawner, and even the landlocked species tends to show its anadromous inheritance as it runs into the mouths of tributary streams to spawn. Selecting an area with a clean bottom, the female scatters her adhesive eggs allowing them to settle and cling to gravel and small stones. The smelt also has been known to spawn near the lakeshore wherever it is able to find clean gravel or sand. The young move back to the lake by autumn, where, as adults, they will travel to deeper water in large schools.

The young smelt feeds on plankton, but as a predacious adult will search out a variety of invertebrates and fish. They often are seen feeding on the surface of the water at night. During the spring runs, they themselves are a favorite of the angler, since many people consider smelt to be a prime eating delicacy.

Sculpin

Cottus spp.

11. Several species of sculpin can be found in Pennsylvania waters, the mottled and slimy the two most abundant and common. They are related to the larger variety of marine sculpins of the cold seas. The sculpin is a bottom dweller, often found in our smaller headwater streams, although they are known to occur in some lakes as well. They are included here because of their close association with trout and their preference for coldwater habitat.

Sculpin generally are described as being dark brown to grayish olive in color, with a mottled or splotchy pattern across the body. Two dorsal fins, one spiny, the other soft-rayed are predominantly displayed on the back. A small fish, the sculpin rarely exceeds five inches in length.

The sculpin is a spring spawner which prefers to deposit its eggs in fast water. Seeking out a stream riffle, the sculpin will find a cavity where the sticky egg mass will be deposited to cling to the underside of rocks and stones. The male guards the nest during incubation.

The sculpin feeds on aquatic insects, small crustaceans and even some vegetation. The sculpin itself, becomes a favorite food source of trout and certain members of the pike family. As a result, it is a favorite bait of the trout angler.

WARMWATER FISH
COOLWATER FISH
COLDWATER FISH

What's the Difference?

What is meant when we refer to a fish as being a "coldwater fish"? . . . a "warmwater fish"? . . . and more recently, a "coolwater fish"? And what, if anything, do these terms have to do with defining a fish?

A broad definition of a fish would go something like this: "A fish is an aquatic animal, a cold-blooded vertebrate adapted for living in water with limbs developed as fins (as opposed to fingers or toes), and, which body terminates in a broad tail (caudal fin)." Thus, the fish is placed below reptiles and amphibians, many of which have limbs that have developed into fingers or toes, though all are classified as cold-blooded. Being cold-blooded means, of course, that the body temperature of these animals is not regulated internally, but approximates that of their environment. As the ambient temperature changes, the body temperature of the cold-blooded animal likewise will change. In the event the temperature reaches intolerable levels (either high or low), the animal will seek relief by moving to another area.

Not to be confused with cold-blooded is the term "coldwater fish", used to loosely define, or classify, a certain group of fishes according to their temperature preferences. And warmwater fish. And coolwater fish. As one might expect, the fishes are somewhat distributed by temperature preferences, coldwater fish to the north, warmwater fish to the south. Pennsylvania, finding itself geographically somewhere in between, becomes a transitional state, and so we have fish falling into both of these categories plus a third group, the coolwater fishes.

Fishery biologists recognize 70 degrees water temperature as being a nominal dividing line separating coldwater fishes from warmwater, with the coolwater species overlapping the two, though temperature extremes are not rigorously defined. Coldwater fish are those preferring water temperatures lower than 70 degrees, in most cases closer to 60 degrees as a maximum. Trout and salmon fall into this category. Fish preferring temperatures higher than 70 degrees, perhaps even in the 80s, are considered warmwater fish and would include such fish as the largemouth bass and the catfishes. Those overlapping the upper range of the coldwater fish and the lower limits of the warmwater fish, say from 65 to 75 degrees, are considered coolwater species. Only recently have biologists begun to refer to this group separately and include here the perch and the pike families. It's thought that several stream dwellers of the sunfish family might also be considered as coolwater species —the rock bass, redbreast sunfish and the smallmouth bass.

Another point to consider is that oxygen demand varies among fishes and this, too, becomes a factor in classifying a particular species as coldwater, etc. For example, trout and salmon (coldwater species) require more oxygen to survive than fish classified as warmwater. And perhaps not by chance, cold water is capable of holding more oxygen than warm water, thus is better able to meet that need.

Coldwater, coolwater, warmwater . . . just one more means of separating and identifying the diversity of Pennsylvania's fish life.

Coolwater/Warmwater Species

Largemouth Bass

Micropterus salmoides

1. Here's a bass that really isn't a bass at all. Like its cousin, the smallmouth bass, the largemouth bass is a member of the sunfish family and in Pennsylvania is in fact, its largest member. A two- to three-pound largemouth would be considered a respectable size in Pennsylvania, although it can, and often does average higher. It may easily attain 20 to 26 inches in length which would be about a ten-year-old fish; a seven- or eight-year-old largemouth will measure about 18 inches.

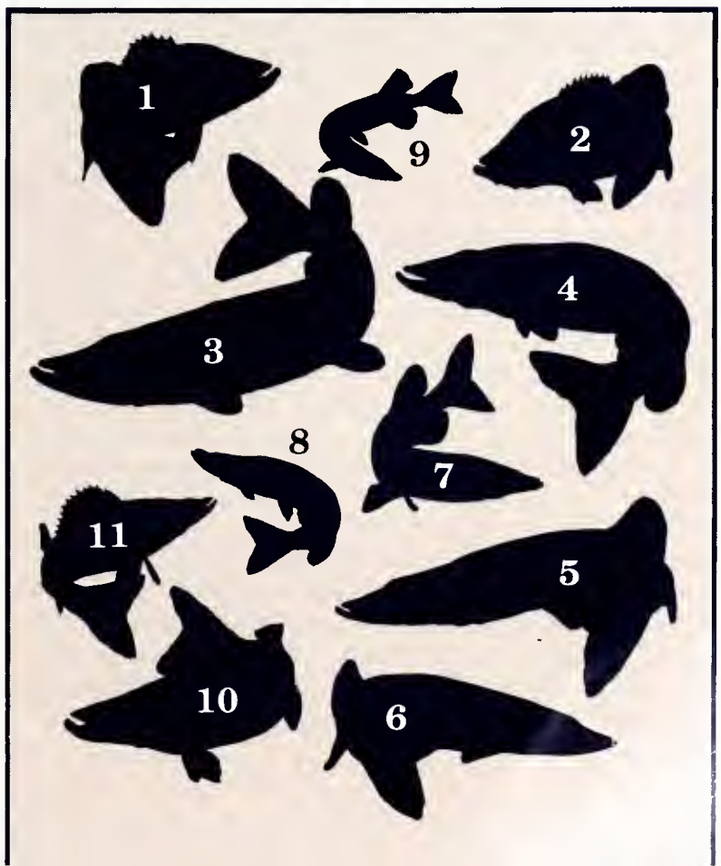
Its former range in Pennsylvania was probably restricted to the western side of the Appalachian Mountains, but today the largemouth bass is found statewide in nearly every lake and pond. Although its primary home is in lakes where it likes to loll about in weedy areas, the largemouth also can be found in sluggish or backwater sections of streams or rivers. The largemouth is tolerant of a wide range of habitat, but prefers clear, quiet water marked with a profuse growth of underwater plant life. It likes to spend most of its time in the seclusion of this aquatic-rooted vegetation and will rarely venture far beyond it. Home to the largemouth is usually in water 20 feet deep or less.

Colored almost black to a dark green above, the largemouth's lower sides and belly shade to a silver or greenish-silver. A series of closely-spaced dark blotches combine to form a lateral band or horizontal bar which runs from the head to the tail. This bar, however, is not always apparent, especially in older fish which tend to be a more uniform, pale dull green with a darker back. Its spinous and soft-rayed dorsal fins are separated by a deep notch which extends almost to the base of the fins, one of two distinct identifying characteristics in separating the largemouth from the smallmouth bass. The other is the mouth. When closed, the mouth of the largemouth extends well past the back margin of the eye, which is not the case with the smallmouth (See *Figure Two*). Its mouth is very wide and anglers have often dubbed him "bucketmouth" as a result of this cavernous opening.

As water temperatures warm to 62 - 65 degrees in spring and early summer, the male of the species can often be observed preparing a site in preparation for spawning. Although the nest can be constructed over gravel shoals, most often he'll find a suitable area over the roots of aquatic plants in areas of relatively soft bottoms. The depressions, usually 20 inches or so in diameter and six inches deep, normally will be located within seven feet of the shoreline in one to three feet of water. One or more females will deposit her adhesive eggs to cling to the bottom of the redd which the male then aerates with a slow swimming motion of the tail. The female deposits only a few hundred eggs at a time and will return later to release more, or, not being especially selective, may move on to deposit additional eggs at a different nest. Dutifully, the male aggressively guards the eggs and later, the newly hatched fry. Hatching occurs within seven to 10 days of deposition, depending on water temperature. The young fish remain on the nest until the egg sac has been consumed, after which they'll travel in a school until reaching about one inch in length.

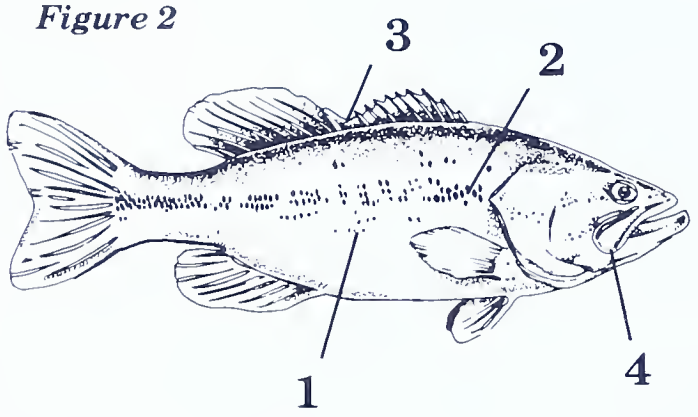
The largemouth bass is voracious in its feeding habits, taking aquatic insects early in its life. Because of its ability to handle larger food and its predacious personality, the growing largemouth quickly changes to consuming crayfish and fish as the primary source of its diet.

Although perhaps not as scrappy a fighter as the smallmouth, the largemouth is, nonetheless, a fish whose popularity is growing at an ever-increasing rate. It rates its own fan club, and is perhaps more responsible than any other fish for the development of



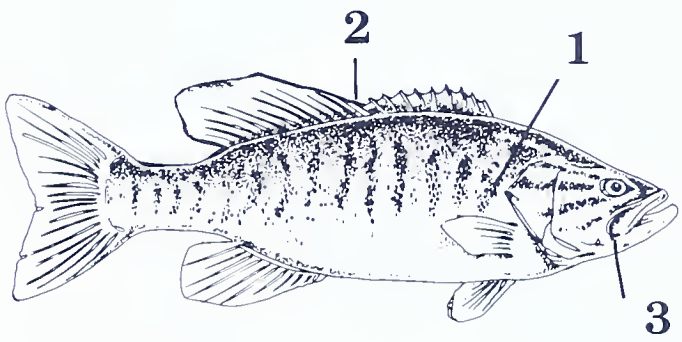
new fishing techniques and a whole new store of equipment. Although popular as a sport fish, the largemouth bass is also considered quite palatable, especially during the colder months.

Figure 2



Largemouth Bass

1. Usually dark green above, sides lighter green shading to white on belly.
2. Broad stripe along the sides, sometimes broken up into blotches.
3. Forward, spinous dorsal fin separated from rear soft-rayed dorsal fin by a deep notch.
4. Upper jaw extends beyond the eye.



Smallmouth Bass

1. Brownish cast above fading to dusky silver below, with dark olive-colored, vertical bars
2. Two dorsal fins separated by shallow notch
3. Upper jaw does not extend beyond the eye

Smallmouth Bass

Micropterus dolomieui

2."One heck of a scrappy fighter" is the way many anglers would describe the smallmouth bass. Some might even argue there isn't a fish around that will put up a more vigorous fight when hooked. In any event, the smallmouth bass has become one of the most sought after fish in Pennsylvania waters. The strength of its long runs and habit of unrestrained bursts from the water have made it an extremely popular game fish.

Originally found only in the Great Lakes drainage and the Ohio River watershed, the smallmouth has been successfully introduced to waters throughout the state. Today, there is hardly a river or suitable stream anywhere in the Commonwealth that does not have at least a minimal population of smallmouth bass.

The smallmouth likes warm, clear streams and is especially fond of streams having a good percentage of riffle areas interspersed with flowing pools, particularly those having a gravel or rubble bottom. It is in these areas the smallmouth can often be found in large numbers. Interestingly, it is a habitat commonly shared with the rock bass. Not restricted entirely, however, to streams and rivers, smallmouth have adapted to quite a few of our lakes, particularly where dams have been constructed across an important smallmouth river. Optimum summer temperatures fall in a wide range of 60 to 80 degrees.

The smallmouth bass is usually a dull golden-green in color with a bronze overcast, descriptive in his nickname, "Ol' Bronzeback". The belly is usually silvery. Numerous dark spots on its sides tend to form short vertical bars more or less olivaceous in color, and there are three dark bands radiating from the eye rearward and across the cheek. The size of the mouth is an important identifying characteristic in distinguishing the smallmouth from the largemouth. When looking at a smallmouth from the side, it is easy to see the mouth *(Figure Two)* does not extend to the rear border of the eye or even come close to it. Not so the largemouth, whose mouth will extend past the rear border of the eye. The two-part dorsal fin, comprised of a spinous and a soft ray, is continuous, but with a shallow notch between the two. In Pennsylvania, the maximum size may be something just over five pounds. A 20-incher is not uncommon, but 24 inches of smallmouth would be about tops.

Mature at three years of age, or approximately nine inches in length, the smallmouth bass will spawn from May to early June or when the water temperatures have climbed to the 60- to 70-degree range. The male prepares the nest, using his tail to fan out a depression in gravel or sand. Located near deep water or overhead cover, the redd normally will be constructed in water that is three to four-feet deep, although some have been found in water as deep as 20 feet or more. The nest might be anywhere from 14 to 30 inches in diameter. Often, more than one female will deposit eggs in a single nest. Eggs are produced at the rate of 2,000 to 7,000 eggs per pound of body weight. They'll incubate and hatch in two to nine days. The small fry will leave the relative safety of the nest after only a few hours of swimming up and at that point, receiving little parental care, are pretty well left to fend for themselves.

The smallmouth bass feeds mainly on crayfish, small fish and aquatic insects. Its flesh is firm and sweet and considered quite palatable by most people.

Muskellunge

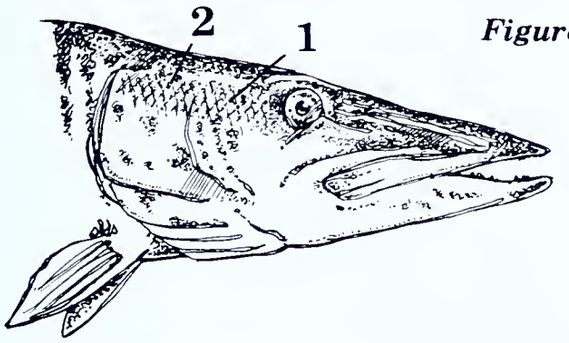
Esox masquinongy

3."Mere machines for the assimilation of other organisms," is the way David S. Jordan, a noted turn-of-the-century fishery biologist, described the muskellunge. Perhaps a bit of an exaggeration, but nevertheless, the muskellunge is one of our most important trophy fishes. It is a fish with a list of names as big as its appetite. Perhaps numbering nearly 50 in all, most of the labels tacked on to this fearsome-looking fish are variants derived from an Indian dialect meaning "ugly fish".

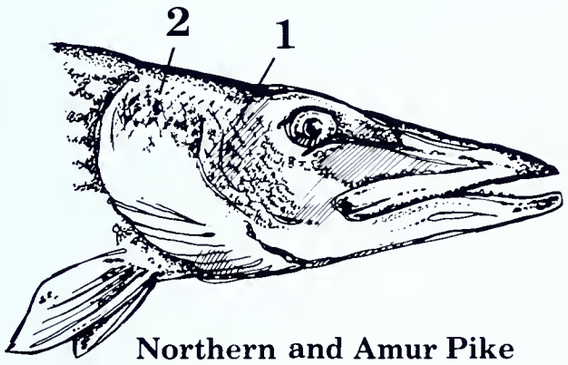
The original range of the muskellunge in Pennsylvania was limited to the northwest part of the state. Native to the Ohio River and Lake Erie watersheds, the muskie has long been a prominent resident of several lakes and river systems in and around Crawford and Erie Counties in particular. Propagation programs maintain a muskie fishery in nearly every other county in the state where anglers eagerly seek out this strong, cunning fish.

Like other members of the esocid (pike) family, the muskie is a solitary fish and is territorial in nature. It can be found in lakes as well as rivers and streams, preferring quiet backwaters edged with an ample supply of aquatic vegetation. The muskellunge likes to lie in water that is fairly shallow, usually 15 feet or less, although there are times when it will be found in water as deep as 40 to 50 feet.

Figure 3



Muskellunge
1. Cheek scaled only on upper half
2. Gill cover scaled only on upper half

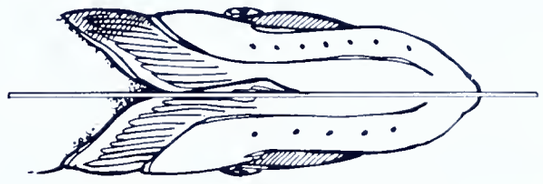


Northern and Amur Pike
1. Cheek fully scaled
2. Gill cover scaled only on upper half

Seemingly built for speed, the streamlined body of the muskie is long and cylindrical, the front of the head shaped like a duck's bill. The soft-rayed dorsal and anal fins are set far back on the body providing a missile-like appearance. There are two excellent methods which can be used by confused anglers to identify the muskellunge from the northern pike. The muskie has *no* scales on either the lower half of the cheek or the lower half of the gill cover (see *Figure Three*). And looking on the underside of the head, the muskie has six or more sensory pores on either side of its jaw; the northern pike has five or less (see *Figure Four*). The muskie is

Figure 4 *(view from below head)*

Muskellunge — 6-9 pores



Northern Pike — 5 pores

usually a light gray to greenish in color, although this may vary depending on habitat and diet, as is true with almost all species of fish. In younger fish particularly, the body of the muskie is accented with irregular dark vertical bars. These bars may, however, disappear with age resulting in fairly uniform coloration along its sides.

The muskellunge spawns in the spring when water temperatures are at an optimum 48 to 56 degrees. Spawning after the northern pike has completed its similar ritual, the muskie will seek out an area in shallow water (often no more than six- to 12-inches deep) over submerged stumps and logs. The adhesive eggs are randomly scattered over a wide area but near good cover, where, after hatching in eight to 14 days, the young fry will attach themselves to aquatic weeds. No parental care is given to the eggs or newly hatched fry. As a result, infant mortality is high as panfishes and other piscivorous fishes target on the helpless young.

Probably no other fish in Pennsylvania can compare with the muskie as quarry for the sport angler. Muskellunge weighing 20 to 35 pounds are not unusual and anglers regularly report catches of this monster measuring 38 to 45 inches and more; several are reported each year topping the 50-inch mark. The muskie simply can't be matched for sheer strength and the visciousness of its strike. Also quite palatable, the muskie is considered by many to be the best tasting of all the pikes.

Northern Pike
Esox lucius

4. Second in size only to the muskellunge, the northern pike possesses many of the same habits and features as its close relative. Malevolent in appearance and aggressive in its behavior, the northern pike in days gone by had often been identified with Luce, the waterwolf (hence, *Esox lucius*). Indeed, its many rows of canine-like teeth, lining the inside of a long, flattened, but powerful jaw, help project an overall formidable appearance.

In Pennsylvania, the northern pike formerly ranged only in the upper Ohio River drainage, most notably the Allegheny River watershed, as well as Lake Erie. Hatchery operations, however, are used to provide a northern pike fishery in some waters outside its natural range. Anglers will often find the northern pike in its favorite habitat, the shallow weedy areas of lakes and

ponds. It will be found to a lesser extent in rivers. Preferring to be alone, the northern pike will establish a territory and fend off intruders, including others of its species.

The coloration and patterns associated with the northern pike make it an attractive and photogenic fish. Its sides are yellow green, shading to a dark green over the back; the belly is usually whitish. The sides of the northern are profusely covered with yellow bean-shaped spots. The fins, including the tail, are highlighted with dark spots and are often multi-colored with black and red markings. The body of the northern is extremely elongated; the head is large with a flattened appearance on its top surface. Like other members of its family, the single dorsal fin of the northern pike is set far back on the body, just short of the tail. Unlike the muskellunge, the cheek of the northern is scaled over the entire surface; however, the gill cover is scaled only on the upper half, matching the muskie (see *Figure Three).*The mandibular pores (tiny holes on either margin of the lower jaw) number five or less on the northern pike and are an important indicator in comparing the northern with the muskie (see *Figure Four).*

The spawning pattern of the northern pike closely parallels that of the muskie, except that it occurs earlier in the spring, soon after ice is out. Most spawning northern pike are three to five years old, and studies have shown that most of the spawning activity occurs during the middle of the day. Eggs are spread over marshy areas where they adhere to brush and vegetation. They are left unattended and suffer a low survival rate due to heavy feeding pressures by other fish. Those that do survive will prove to be one of our fastest growing freshwater fish. Northerns up to 20 pounds are not unusual in Pennsylvania and quite a few of them will exceed that size.

The northern pike is an important game fish, noted for its strong will and good fighting ability. Its size excites even the most complacent of anglers. Live bait and wobbling spoons are the most popular bait and northerns are often easily caught due to their insatiable appetite. As to table fare, Izaak Walton once wrote, "The northern pike, roasted, is choicely good — too good for any but anglers and honest men."

Tiger Muskellunge

Esox masquinongy & E. lucius

5. If, as said by many, the northern pike is to be considered the waterwolf, here then, is the tiger. The tiger muskellunge. A hybrid species, the tiger is raised in Pennsylvania Fish Commission hatcheries and is obtained by taking eggs from the purebred muskellunge and fertilizing them with the male northern pike. The resultant hybrid muskie is more hardy than its female parent and has greater vitality.

The tiger muskie has habitat requirements very similar to the purebred muskie and it has adapted well to large lakes and rivers; it has been stocked throughout the state. More restless than either of its parents, the tiger tends to be more mobile, wandering over a wider area in search of food to satisfy its hunger.

The tiger muskie is colored a light green on the sides shading to a somewhat darker green over the back. The belly is off-white. Vertical dark gray-green bars appear to run off the back and down the sides to near the belly. These bars are about equal in width to the lighter bars separating them and have a tendency to break up into spots on their lower ends. On the other hand, the bars on the purebred muskie are not equal in width and this characteristic may be used as at least a preliminary means of distinguishing between the two. Generally, the cheek of the tiger muskie is completely covered with scales while the gill cover is scaled on its upper half only (See *Figure Three).* We say "generally", because being a hybrid, this may not always be true since there can be some variation depending on the genetic makeup of any particular specimen. The body of the tiger appears more plump than the purebred muskie due to the tiger being shorter and more robust.

There is no natural reproduction of the hybrid species since the male tiger muskie at least, is sterile. Hatcheries are able to produce sufficient quantities of the tiger muskie, however, since they are easily reared. The survival rate between the time the eggs are taken and fertilized, through hatching and growth to the "fry" stage is higher than either of the parents. In addition, the tiger exhibits a superior growth rate. It will feed on dry pellets (similar to a trout) while in the hatchery system, something the purebred muskie will not do. Thus not needing a large amount of live food, the tiger muskie is logistically easier and more cost effective to produce.

The tiger muskellunge is an excellent sport fish and relatively easy to catch when compared to the purebred muskie. It also is an important predator, filling a vital niche in its aquatic environment.

Amur Pike

Esox reicherti

6. This member of the pike family is not native to Pennsylvania waters (nor, for that matter, any others within the entire United States). It was imported to the Keystone State and from a long way off, at that. Introduction of the Amur (pronounced Ah-MOOR) pike, however, makes Pennsylvania the only place in the entire world where it is possible to catch every member of the pike family.

The Amur pike is native to Asia and the Amur River basin. The Amur River, some 1700 miles long, forms part of the boundary between China and Russia and was the source of the first Amur pike introduced to the United States as a result of a trade some years back. During the period from 1968 to 1970, the United States Department of Interior, Bureau of Sport Fisheries and Wildlife supplied eggs taken from striped bass, smallmouth bass and steelhead to Russia. In return, the Soviets sent eggs taken from the Amur pike to this country. The eggs were subsequently assigned by the federal agency to the Pennsylvania Fish Commission for hatching, study and eventual experimental release in Glendale Lake, Cambria County. This particular lake was selected because a pollution block would prevent the new predator species from escaping into other

waters as the Commission continued its investigations. The Amur pike took hold and now offers Pennsylvania anglers a new species with all the fighting qualities they've come to expect from a member of the pike family.

The Amur pike has a light, silvery body, becoming somewhat darkened over the back. The body is covered with prominent dark brown to black spots. These spots are bean-shaped in the younger fish, but as the fish grows, the spots appear in a more irregular pattern and become more circular in shape. The Amur is easily distinguished from other members of its family even though it has the typical fang-like teeth set in the familiar duck bill-shaped jaw. Its cheeks are completely covered with scales; the gill cover is scaled only on the upper half (see *Figure Three).*

Even though in its native range it is separated by many thousands of miles from other members of the esocid family, the Amur pike spawns in the spring, typical of the species. Occuring after the northern pike and muskellunge have completed spawning, eggs are deposited by the Amur in shallow water, often in a flooded, heavily vegetated area. The eggs are scattered at random and left unattended, a practice not unlike that of the other pikes. The growth rate and maximum size of the Amur pike is very similar to the northern pike.

The Amur pike provides good sport for Pennsylvania anglers who have found this species to be a fairly easy target, especially when fishing through the ice. In fact, ice fishing probably provides the greatest rate of return. The Amur pike lives up to its family name as a predator fish, adept at keeping other fish populations in check.

The Pennsylvania Fish Commission will continue to study this interesting species, especially since attempts to learn more about it from the Soviet Union have proved fruitless. It should be noted, however, that "hook and line" fishing as we know it, apparently is not engaged in to any great extent in Russia. Harvest there has been limited to netting by commercial fishermen.

Chain Pickerel

Esox niger

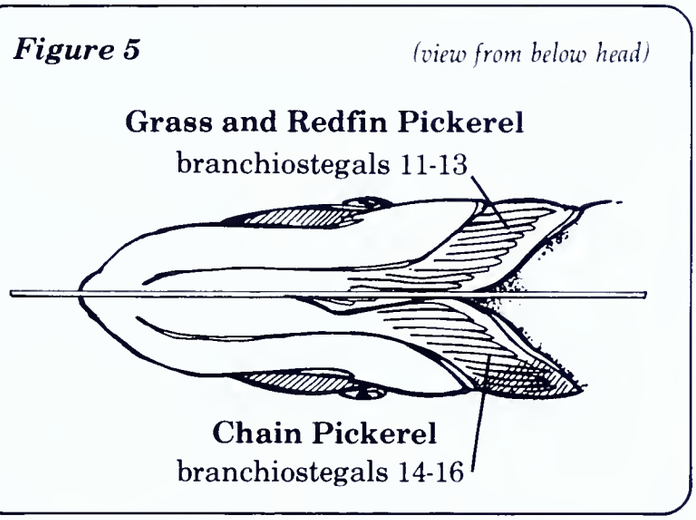
7.Easily the most often caught member of the pike family in Pennsylvania, the chain pickerel is also the most numerous and widely distributed. Its native haunts covered roughly two-thirds of the state, since its original range included the Delaware and Susquehanna River basins. It is especially abundant in the northeast counties, particularly in the numerous glacial-formed lakes and ponds.

Home to the chain pickerel can be a variety of habitats. Although most often found in lakes and ponds, the chain pickerel adapts well to life in streams and rivers of varying sizes, particularly those that are clear and sluggish. It likes weed beds, submerged stumps and logs. And even though it's often observed hovering over clean, shallow shoals, heavy with vegetation, it is just as likely to plunge into the open waters of a deep lake. In any event, like others of the family, the chain pickerel will not travel far from its established retreat.

The chain pickerel gets its name from the dark chain-like or reticulated patterns on the sides. The background color ranges from a dark yellow green or brassy on the sides to bronze across the back. Its belly is usually an off-white. "Ol' Chainsides," as he is often called, has cheeks and gill covers that are completely scaled. Identifying characteristics to aid in distinguishing between the chain pickerel and the smaller redfin and grass pickerel are shown in *Figure Five.*

The spawning habits of the chain pickerel are the same as the other pikes. Early spring sees eggs deposited at random over weedy areas where, after hatching, the young fry attach themselves to the underwater stems. Again, other larger fish, foraging for a meal, take their heavy toll of the still-developing youngsters. "Chainsides" will live to be eight to ten years of age and may attain a length exceeding 30 inches. In Pennsylvania, weights of two pounds are common and considered quite acceptable. Heavier weights of four or five pounds are often reported with lengths of 25 inches or more. The state record chain pickerel weighs eight pounds.

Figure 5 *(view from below head)*



The chain pickerel feeds on other fish, carefully stalking them through a myriad of underwater growth. Crayfish, aquatic insects and frogs also make up some of their diet, indicating a preference for food no more specific than their choosing a particular habitat. They are said to feed most actively at dawn and again during the twilight hours.

A favorite of ice anglers, "Ol' Chainsides" provides an excellent year around fishery. Its flesh is sweet, firm and flaky, especially during the colder months, and thus is considered excellent table fare by many.

Grass Pickerel

Esox a. vermiculatus

8.The grass pickerel, along with the redfin pickerel, are the two smallest members of the pike family. Rarely exceeding 12 inches in length, these two "shorties" are often mistaken for immature northern pike or muskellunge. They are nearly identical in appearance and structure and apparently the only major difference between these two esocids is their natural range. The grass pickerel, restricted to the western side of the

Allegheny Mountains, inhabits the Ohio River and Lake Erie watersheds. Although the grass pickerel prefers the marshy areas of lakes and ponds, it is often a stream dweller and can be found in slow-moving water where a soft bottom holds the roots of a variety of aquatic plants.

Although the grass pickerel will often lounge in shallow water, its size and color combine to form a natural camouflage, effectively concealing him from view. The sides and back of the grass pickerel are a greenish to grayish color, accented with dusky streaks, wavy or wormy in appearance and running in a more or less vertical direction. These streaks sometimes are numerous and close enough to give the illusion of vertical bars, but more often are shadowy vermiculations. The dorsal and anal fins, set far back on the elongated body, are characteristic of this family of fishes; the fins of the grass pickerel are unmarked. Scales completely cover the cheek and gill covers as they do on the other pickerels. Refer to *Figure Five.* for help in separating this pickerel from the chain pickerel.

The grass pickerel spawns in the spring, usually in April or when the water temperatures reach the low 50s. Spawning is accomplished without benefit of a nest and the adhesive eggs are randomly scattered over vegetation. Once the eggs have been released and fertilized the parents depart, showing no further concern for their progeny.

The grass pickerel's main diet is comprised of crustaceans and invertebrates, the prey taken increasing in size as the pickerel grows to a larger length. A few fish also will be consumed from time to time.

Although very rarely (if ever) attaining sport fish size in a legal sense, the grass pickerel does, however, provide good action when caught on light tackle. And even though the angler will have to return the grass pickerel to the water, he can add one more member of the esocid family to his lifetime list.

Redfin Pickerel

Esox a. americanus

9. The redfin pickerel fills in that part of the state not inhabited by the grass pickerel. Residing in waters east of the Allegheny Mountains, the redfin pickerel is more apt to be found in the Delaware River watershed, less often in the Susquehanna River drainage. Their natural range is perhaps the most accurate means in distinguishing between the redfin and grass pickerel, since there is little physical or biological difference between the two. Their appearance can easily fool the angler who may confuse either one with the young of a muskie, northern or even the chain pickerel. (See *Figure Five* for help in separating the chain pickerel from the redfin and grass pickerel.) The smallest of the pikes, both species nonetheless have habits that are inherent in this family of predacious fishes. Twelve inches is about the maximum length attained.

While the redfin pickerel will often make his home in the shallow weedy areas of a lake, it seems to prefer slow-moving streams. And it is here that it is most often encountered by a surprised angler. It especially takes a liking to waters that tend to be naturally acidic.

As noted previously, the redfin exhibits the same physical traits as the grass pickerel with but one exception: Not surprisingly, its fins usually have a reddish tint.

The spawning habits of the redfin also follow those of the grass pickerel, the timing perhaps being the only variation. Differences in weather patterns across the state may cause one species to begin the ritual ahead of the other.

Crayfish and other small crustaceans and aquatic insects make up the primary diet of the redfin as well as the grass pickerel. Few fish are hunted in the course of routine feeding, apparently due to the small size of the hunter.

Walleye

Stizostedion vitreum

10. Called over the years by a variety of names, none of which correctly identifies its true family, the walleye, nevertheless, is one of our most popular and sought after fishes. Referred to as a "Susquehanna salmon" or "walleyed pike", even "pickerel", the walleye is neither a salmon or pike. Rather, it is a member of the perch family, related to the yellow perch, the sauger and several small, colorful darters classified as baitfish.

The walleye is a native of mid-North America (here, to include western Pennsylvania) but has been widely introduced throughout the state, including the Susquehanna and Delaware River watersheds. It has adapted well to its new environs and thrives in many of our waters where anglers often report trophy-sized catches. Walleye weighing one to three pounds are quite common, weights of six to eight pounds not particularly unusual. Lunkers weighing in at ten pounds and more turn up quite frequently, winning for the angler a Pennsylvania Fish Commission Angler Award.

Although the walleye is more abundant in larger lakes, it will easily accept living in moving water and thus can be found in many rivers and large streams. It shows a preference for water that is moderately deep with a rock, gravel or sandy bottom, and clear; it won't tolerate turbidity as much as the sauger, a close relative. Anglers know the walleye to be a school fish, traveling in large groups that sometimes range over a wide area. The walleye prefers a summer water temperature under 85 degrees.

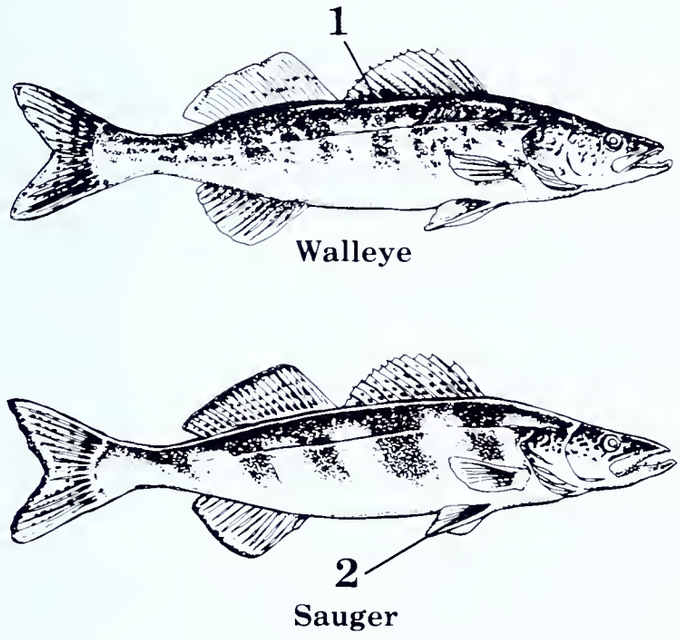
The body of the walleye is yellow olive to a mottled brassy color with irregular spots on the body that tend to join, forming a series of dark blotches extending over the back. The belly is light colored. The walleye has sharp-pointed, almost fang-like canine teeth lining the lower jaw. Its eyes are milky or glassy in appearance and capable of reflecting light at night. The walleye has two separate dorsal fins, one spinous, the other soft-rayed. The anal fin also has one or two spines. Several characteristics can be used to separate the walleye from the smaller sauger. The walleye has a dark spot at the rear of the spiny dorsal fin, usually at the base of the last two or three spines; the sauger does not. On the walleye, the lower lobe of the tail is whitish in color. The sauger on the other hand, has a tail that is evenly colored, with no white area. And, whereas the sauger

has a black spot at the base of the pectoral fin, the walleye does not. The sauger also has more of a barred pattern overlapping the back and sides in contrast to the walleye's blotchy appearance. Except for these several items, the walleye and sauger are very similar in appearance.

Usually, by the time a walleye reaches a length of 12 to 15 inches, it is sexually mature. Spawning occurs in the spring, often even before ice has completely cleared the lake or river. The female begins to move toward the spawning area as water temperatures approach the 45- to 50-degree mark. The walleye will return repeatedly to the same spawning site used on other occasions, even though the site may be some distance from its usual habitat. The eggs normally will be scattered randomly over rocky or gravel-covered shallows, although the walleye may at times run upstream to flooded marsh grass. Ideally, the eggs should be deposited in a current, whether flowing water or wave action on the edge of a lake. This constantly moving water ensures a better survival rate since the eggs, which have settled into spaces between the gravel, are continually aerated. The eggs, deposited at night in most cases, will hatch in 12 to 18 days depending on water temperature. At the rate of about 25,000 eggs per pound of fish, as many as 25,000 to 500,000 eggs may be deposited by one female walleye.

The young fish will survive on the egg sac attached to its body for several days, graduating to zooplankton as the egg yolk is consumed. As it becomes older, the walleye will feed primarily on fish, although aquatic insects and crustaceans also make up some of its diet. The walleye is nocturnal for the most part and this is when most of its feeding activity takes place. It is considered a very predacious fish and quite effective in helping to control populations of other fish.

Along with its voracious personality, the walleye is also a highly rated game fish. Its flesh is savory,and it is held in high esteem as a food fish.



The walleye has a dark spot at the base of the last two or three spines of the dorsal fin (1); the sauger has a dark spot on the pectoral fin (2).

Sauger

Stizostedion canadense

11. The sauger (pronounced SAW-gur) can be described as a fish on the comeback trail. Anglers are reporting catches of the sauger in increasing numbers throughout the Allegheny River, part of its original range, but from which it had disappeared for a number of years. Studies by Pennsylvania Fish Commission biologists confirm that sauger are indeed, making their way back to the Ohio River watershed. They have been located in the large river impoundments of the Monongahela, Allegheny and Ohio Rivers. The native range of this member of the perch family also included Lake Erie and a large area extending through the central United States and southern Canada. It never occurred east of the Appalachian Mountains, so thus was never known in any of the Atlantic Coast drainage systems. The sauger is apt to travel great distances and prefers the largest of lakes and large free-flowing rivers. It is quite tolerant of turbid water and silt-covered bottoms of lakes and rivers, a characteristic not true of its cousin, the walleye, which prefers clear and considerably cleaner water.

The belly of the sauger is white, becoming olive-gray on its sides and back; it sometimes is highlighted with a brassy tinge. Three or four dark saddles cross the back, dropping partially down each side. The forked tail of the sauger is a uniformly-colored dusky to yellowish; the lower lobe is not white as on the walleye. The dorsal fin, divided into spinous and soft-rayed portions, contains horizontal rows of small dark spots. Unlike the walleye, the spinous dorsal fin does not have a dark spot at its base. There is, however, a dark spot at the base of the pectoral fin of the sauger which the walleye does not have. The mouth is armed with many fang-like teeth.

The sauger spawns in the spring, beginning when water temperatures reach 45 degrees. Occurring at night, the eggs are scattered randomly over a gravel or rubble-strewn bottom. Although spawning can occur in lakes as well as rivers, good reproduction and rate of survival is said to be dependent on a large river. The sauger grows at a slower rate than the walleye and does not attain as large a size. Fifteen to 17 inches is probably about the maximum length, coming in at about three pounds or so.

Along with the walleye, the sauger is a nocturnal feeder, meaning he spends his nights looking for prey to satisfy his voracious appetite. Like the rest of his family, the sauger is carnivorous. Young sauger feed mainly on zooplankton and midge larvae before beginning to take forage fish.

Again becoming an important sport fish throughout its original range, the sauger is often taken from areas downstream of the dams. He is considered every bit as palatable as the walleye.

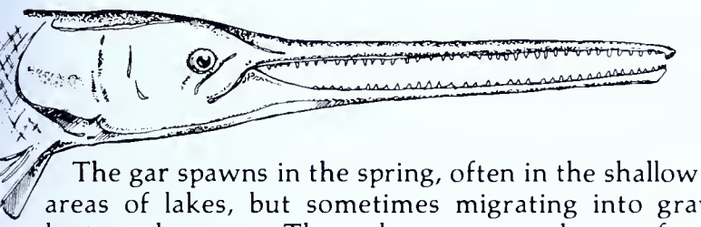

Том Дилэни

Miscellaneous Species

Longnose Gar
Lepisosteus osseus

1.The longnose gar, representing an ancient family of fishes in Pennsylvania, is probably the oldest of the living fishes. It is a primitive bony fish that has been reported in widely scattered areas in the state. Its original range included the Mississippi drainage (hence the Ohio River and Allegheny River watersheds in Pennsylvania), the lower Great Lakes and the Atlantic Coast as far north as New Jersey. In Pennsylvania, the gar has been found principally in the Lake Erie basin, a few western counties, to some extent in the Delaware River, and on rare occasions in the extreme southern portion of the Susquehanna River watershed. It will shy away from strong currents, preferring to reside in lakes and sluggish streams. The gar is able to survive in waters with little oxygen content.

The gar may reach a length of five feet. The jaw, almost beak-like in appearance, contains fine canine-like teeth. A short dorsal fin and anal fin are set far back on an elongated and cylindrical body. Thick, bony diamond-shaped scales "armor plate" the body. The gar is a darkish olive color above and silvery below. There can sometimes be a few large spots placed at the rear of this streamlined body.



The gar spawns in the spring, often in the shallow areas of lakes, but sometimes migrating into gravel-bottomed streams. The male matures at three to four years of age, the female a year or two later. The female may spawn with several males over an extended spawning period. As many as 28,000 to 30,000 eggs may be deposited during this period; they will hatch in six to eight days. The eggs are small and dark and attach themselves to weeds and other objects since no nest is prepared. The eggs of the gar are poisonous to man and other mammals. The gar, which grows very rapidly, may reach 19 to 22 inches in its first year and live to be 20 to 23 years old.

The gar is a voracious feeder and is known to readily prey on other fish. In fact, fish make up the most of its diet, although crustaceans will be consumed as well.

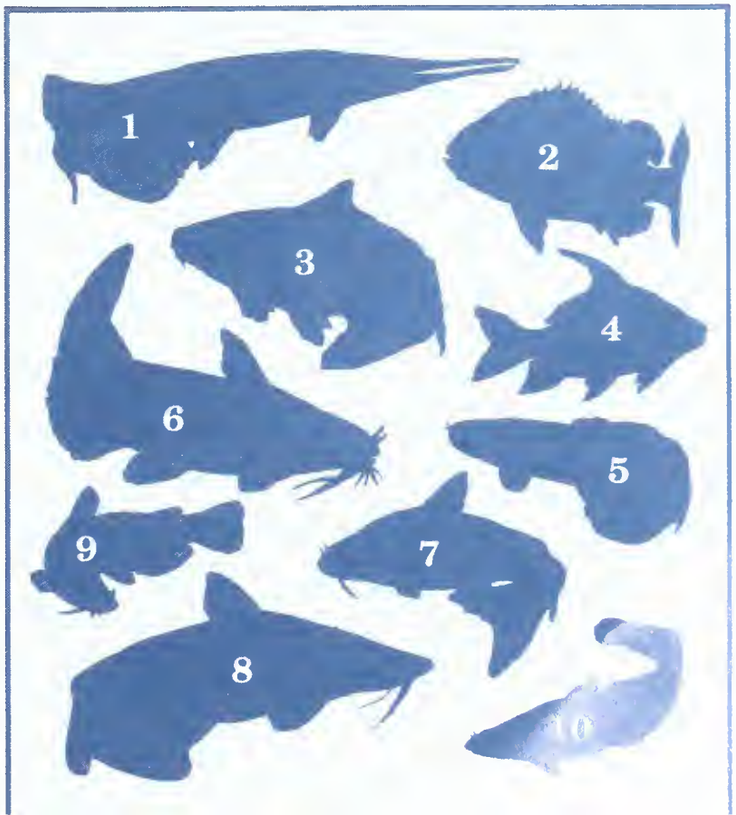
Anglers catching a gar usually do so by accident since it is not readily taken by hook and line. The gar is not considered to be particularly tasty to the palate.

Freshwater Drum (Sheepshead)
Aplodinotus grunniens

2.This freshwater drum, often referred to as a sheepshead, is the single representative found in fresh water in North America, of an otherwise large family of marine species. It is native to waters ranging over a vast geographical area extending from the Hudson Bay to Mexico and beyond. In Pennsylvania, it is common in Lake Erie, and in recent years has been making a comeback in the Allegheny and Monongahela Rivers, part of its original range. It was never known to exist in the Susquehanna, Delaware or Potomac River watersheds. The freshwater drum prefers large, shallow lakes and large river systems where it likes to loll in quiet pools and backwaters. A school fish, more so in the winter than during the summer months, the freshwater drum normally resides on or near the bottom of its watery environment.

With its deep, highly arched body, the freshwater drum almost appears to be hump-backed. Its long dorsal fin, deeply notched but not completely separated, extends from the peak of the "hump" nearly to the tail. The shorter of the two dorsal fin sections is placed in front and is spiny-rayed; the rear and much longer of the two is soft-rayed. Two sharp spines, capable of pricking a misplaced hand, are contained in the anal fin. The tail is rounded or nearly so. The mouth is full of teeth made for grinding. They are large, flat and powerful, almost molar-like. Average size of the freshwater drum in Pennsylvania is 12 to 18 inches. The body of the freshwater drum is grayish silvery on its upper portion, becoming lighter on the sides. Streaks sometimes appear on the back. The belly is milky white.

Not to be outdone by the marine members of this family, the spawning ritual of the freshwater drum becomes a social — and noisy — affair. A rumbling, growling sound produced by the males reverberates



through the water. It is especially audible when the drum are swimming near the surface of the water. The sound is believed to be produced by vibrating certain muscles against the swim or air bladder. Spawning ensues when water temperatures reach 65 to 70 degrees, usually in April or May. Anywhere from 10,000 to 100,000 eggs may be produced by the female who scatters them to adhere to a pebbly bottom; they hatch in about two weeks. No care is provided to either the eggs or young fish.

The freshwater drum feeds on the bottom, the young taking up station in the shallows in search of minute crustaceans. As they get older, a larger variety of food is taken including aquatic insects and fish. The drum also searches through the sediment, gravel and sand in search of mussels which are "crunched open" with ready teeth, apparently provided by nature for that purpose. The hard shell is deftly discarded, the soft body within quickly consumed.

The history of the freshwater drum is steeped in folklore and superstitions. Its ear bones, called otoliths, are very hard and pearl-like — and considered to be "lucky pieces", or so the saying goes. In any event, recent Indian digs revealed many of these otoliths along with other Indian artifacts. It is believed these bone fragments were used as Indian wampum, worn as necklaces to ward off sickness and utilized in various ways for ceremonial purposes.

Freshwater drum today often are caught by anglers while fishing for some other species. They are said to be a strong fighter, not quick to admit defeat. A growing number of people are beginning to appreciate their food value.

Common Carp
Cyprinus carpio

3. To the surprise of many people, the common carp, this "biggy of the backwaters", is a member of the minnow family. With 30 pounds not an uncommon weight, the carp obviously is the biggest of an otherwise lightweight family. Introduced from Europe in the mid- to late-1800s, the carp has spread clear across the Commonwealth and now is found in all 67 counties.

The carp prefers shallow marshy areas, especially those with an abundant amount of weed growth and other organic matter. Even so, he can be found over all types of bottoms and in most any kind of water, although not usually in the faster flowing streams.

The carp is usually a reddish brown with darker tones over the back and dorsal area, shading to a golden olive along the sides. The belly is yellowish white. The body, chunky in appearance, is covered with heavy scales. Two small barbels project from each side of the upper jaw. The dorsal fin extends over a large portion of the back and contains upwards of 20 soft rays.

The carp spawns in the spring to early summer in shallow weedy bays where the adhesive eggs are spread among the growth of vegetation. The carp is a prolific spawner. Several million eggs may be released by one female who will be attended to by several males. Neither the eggs or young are given any parental care.

The carp is an omnivorous feeder, taking a variety of aquatic plants and insect larvae. It can often be seen at work, creating thick clouds of suspended sediment as it uproots plants in search of food.

The carp is a favorite quarry of many anglers who seek a real tussle. The carp always seems reluctant to give up and is a strong fighter with an equally strong will. As to eating quality, that remains a matter of personal preference.

Quillback Carpsucker
Carpiodes cyprinus

4. Here is one of the least known fishes residing in Pennsylvania waters. The quillback carpsucker has confused many an angler who unwittingly finds this somewhat unusual looking fish on the end of his line. Confusing because it looks similar to a "common" sucker around the mouth, similar to a carp viewed from the side (although of a different coloration), but with a peculiar dorsal fin on its back. The quillback carpsucker does in fact, belong to the sucker family, but of a different group than the sucker with which we are most familiar.

Although not found in abundant numbers anywhere in Pennsylvania, the quillback is nonetheless widespread, appearing in all the major watersheds. It has turned up in lakes as well as larger streams and rivers, where it prefers to spend its time in larger, slow-moving pools of water. The quillback favors a gravel bottom and if given a choice would prefer less turbid water. This fish tends to travel in schools, cruising close to the bottom in search of food.

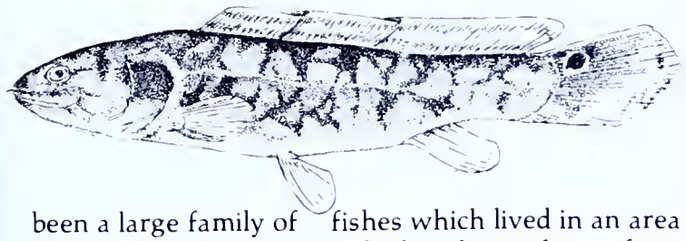
The quillback has a deep body, heavy for its length. The tail is deeply forked with the lobes equal in size. The dorsal fin is an important identifying characteristic. The front rays of the dorsal fin extend into a long lobe, about five times longer than the rear portion of the dorsal. Somewhat pointed, this long projection trails backward over the balance of the dorsal fin. The body of the quillback carpsucker is more or less silver, but becomes a light olive above. Its scales have a tendency to reflect light in tints of greens and blues.

As a rule, the quillback spawns in early summer or when the water temperature reaches about 60 degrees. The eggs, numbering several hundred thousand, are scattered at random in shallow water. A site with a gravel bottom usually is selected. The parents show no further interest in the eggs, and they are left to hatch in eight to 12 days. The mortality rate among the eggs and young fry is very high, and explains at least in part, the quillback's lack of abundance.

The quillback carpsucker feeds much like other suckers. Insect larvae and other organisms found in sediments make up the bulk of its diet. The quillback also is an important source of food for other species and is preyed upon by several game fish.

Bowfin
Amia calva

5. A fish of ancient lineage, the bowfin also is known locally in some areas as the freshwater dogfish. It is a primitive fish and the only living species of what had



been a large family of fishes which lived in an area we now call North America. The bowfin is often referred to as a "living fossil", while in fact, many rock-bound fossils of this previously large family have been found throughout the country.

Today, this lone survivor prefers to live in heavily vegetated lakes and sluggish rivers and can easily tolerate warm water temperatures. The fact is, the bowfin is able to withstand high temperatures during the summer months because his functions stagnate, motor inactivity sets in and he is subdued to insensibility. Along with higher water temperatures of course, come lower amounts of oxygen, but here the bowfin also is able to adapt. Having an air bladder which can function similar to lungs (as does the gar, another primitive fish), the bowfin is able to surface and push its head clear of the water to take gulps of fresh air. This ability to live in stagnant water sets the bowfin apart from most other fish.

The bowfin is olive-green on its back, becoming lighter on the sides to yellow on the belly. It is somewhat mottled. The male has a dark spot at the base of the tail which often is ringed with orange or greenish yellow during the breeding season. Bony plates cover the head while strong scales dominate the body, both characteristic of other so-called "primitive" fish. The dorsal fin is low in profile and extends over half the length of the back, reaching almost to the tail. The mouth of the bowfin is long and filled with strong, sharp teeth. Several barbels extend from near the nostrils. The bowfin may reach two feet in length and weigh upwards of 10 pounds.

When the breeding season approaches, usually in April to June, the male prepares a circular nest in shallow water. Spawning at night, several females will deposit eggs into the nest of a single male. The male will guard the eggs until they hatch in eight to 10 days. He'll continue to watch over the young fry for several weeks more.

The bowfin is a voracious feeder, preying heavily on small fish and crayfish. Aquatic insects also are taken to supplement the diet of this hungry fish.

The bowfin is highly rated as a game fish, even though it is most often caught while the angler is concentrating on fishing for some other, more desirable species. The bowfin is seldom used for food.

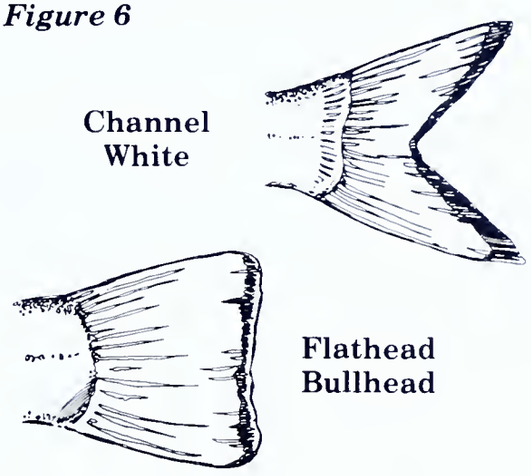
Channel Catfish

Ictalurus punctatus

6. It is probably safe to say that of the catfish family, the channel catfish is the one most sought by anglers. And except for the flathead catfish, it is the largest catfish swimming in Pennsylvania waters; weights up to 15 pounds are not unusual. The channel catfish will adapt to a variety of habitats ranging from clear, moving (often swift) rivers where it'll take up residence over sand, gravel or boulders — to ponds and lakes where it will likely be found in dense weed beds. The channel cat is distributed statewide in Pennsylvania, introduced to many areas where it did not occur naturally.

Several characteristics can be used to separate the channel catfish from others of this family of scaleless fishes, including the flathead, white and the various bullheads. The tail of the channel catfish is deeply forked, but with lobes that are sharply pointed. On larger fish, the fork may be less pronounced and may disappear. The white catfish on the other hand, while its tail is forked, the lobes are not as sharply pointed.

Figure 6



The tail of the bullhead is square to rounded, having no indentation at all (See *Figure Six).* The rays of the anal fin also can be used to separate several species. The anal fin rays on the channel catfish number 24 to 30; the white catfish has less than 25, usually 19 to 23; and, the flathead will have less than 16 rays in the anal fin. The small, fleshy adipose fin on the channel catfish is separated from the tail and serves to distinguish a young channel catfish from the madtoms and stonecats which have the adipose connected to the tail. Like other

Barbels are an important aid in the search for food.

members of the family, the channel catfish has sharp spines on the dorsal and pectoral fins that always seem to be at the wrong place at the wrong time. Eight barbels on this and the other catfishes are placed at definitive spots around the mouth; four under the jaw, two above the jaw, and one at each tip of the maxillary which is the rear-most portion of the jaw.

The channel catfish is bluish to bluish-olive on its back and silvery-grey on the sides. Some specimens appear to be almost a dark steel blue. The belly is white. Except for some adult males, small irregular spots cover the back and sides and the channel cat is the only member of the species having these spots. The barbels are black and very long.

The channel catfish spawns in May to early June with the male taking on several important roles. It is the male who prepares the spawning site, usually a depression in the shoreline, or a burrow excavated out of an overhanging bank. Sometimes sunken hollow logs may be used, or the abandoned hole of a muskrat, long since departed. The eggs, deposited by the female as an adhesive, sticky mass, are jealously guarded by the male, who also provides security for the young when hatching is completed.

The channel catfish is not all that particular when it comes to eating. Worms, minnows, crayfish, aquatic insects and most anything else found around sunken logs and submerged vegetation will satisfy its hunger. Most feeding activity occurs at night, sometimes in swift waters.

The channel catfish is a popular fish on the table. In some parts of the country, and increasingly in Pennsylvania, it is raised commercially and sold to market. Its flesh is white and sweet tasting, a favorite of many.

White Catfish
Ictalurus catus

7. This member of the catfish family originally resided in waters of the Atlantic Coast drainage, principally the Chesapeake Bay and south. In Pennsylvania, the white catfish is considered a native to the Susquehanna River, Delaware River and Potomac River basins, but has since been introduced to sections of the Ohio River watershed. As a rule, the white catfish favors the channels of rivers and streams and other areas where it is apt to find a sluggish current. It will tolerate swifter water, but not so much as the channel catfish. It's also known to inhabit some lakes and ponds and can withstand brackish water more than most catfish.

The white catfish is bluish above and silvery below. It also may be mottled with gray to blue markings. Like others of the species, it has the distinctive adipose fin placed near the base of the tail. The tail is moderately forked, the lobes somewhat rounded and not as sharply pointed as on the channel catfish. The anal fin contains 25 or fewer rays and may be used to help sort out this catfish from several others. The pectoral spine has strong teeth on its rear edge which helps define this fish from several of the bullheads where the teeth on the pectoral spine are not as defined. Eight barbels appear at their usual places around the mouth as is the case with the other catfish.

Spawning habits of the white catfish closely resemble those of the channel catfish, except it is somewhat less migratory when searching for a suitable site. The male either excavates a nest or finds an existing cavity to receive the sticky egg masses. The male dutifully guards the eggs and for a short time, the newly hatched fry.

The diet of the white catfish includes some organic material, although most of its food is comprised of midge larvae, larger insects, fish and crustaceans.

The white catfish is easy to catch with live bait and provides good sport. It is also considered excellent fare when placed on the table.

Flathead Catfish
Pylodictis olivaris

8. Here is a solitary catfish of the large river. In Pennsylvania, where populations had been reduced for some time, probably due to pollution, the flathead catfish again is being found in its original habitat — the Ohio River drainage — in slowly increasing numbers. The Allegheny and Monongahela Rivers are the primary waters where anglers might catch this largest of our Pennsylvania catfish. Normally found over hard bottoms, the adult flathead likes deep, sluggish holes, while the young sometimes scoot about in the riffle areas. The flathead does not occur in the Atlantic drainage, thus is absent in eastern Pennsylvania.

As one might guess from its name, the upper portion of the head of the flathead catfish is low, flat and broad — very much so, in fact. The body is very long, making it the most slender of the catfishes. The tail is square to slightly indented (See *Figure Six).* The dorsal fin is high and protrudes well above the body when extended to its fullest length. There are less than 16 rays in the anal fin and this feature can be used along with other items to help separate this fish from others of the species. The flathead catfish is yellowish brown on the upper part of the body shading to a pale gray below. It is often mottled with darker tones of brown.

Spawning habits of the flathead pretty much follow the pattern of the other catfish, except it usually spawns a bit later than the channel catfish. It is mature at about five years of age. The adults build a nest to receive the eggs, using depressions or other natural cavities. The eggs and subsequent young flatheads are watched over closely, usually by the male.

The flathead catfish feeds on aquatic insects, then crayfish and finally, as an adult, begins to prey on other fish, a favorite food of this large cat.

As a sport fish, the flathead is one of our largest. Over 20 pounds is not uncommon, and they may easily top 30 pounds in Pennsylvania. He is a good, strong fighter and equally good on the table.

Brown Bullhead
Ictalurus nebulosus

9. The brown bullhead is the most widely distributed of the three common bullheads in Pennsylvania and in fact, of any of the catfishes. In addition to the brown bullhead, there is the yellow bullhead, found in all of the state's watersheds, but not nearly so common as the brown; and, the black bullhead, restricted to counties in the western part of the state. The three are very similar, both in structure and in behavior. The bullhead will show up in lakes and ponds and sluggish streams, particularly those heavy with vegetation. It is a bottom dweller, but the nickname "mudcat", is a misnomer. It is

capable, however, of breathing air taken from the atmosphere and can thus live long periods of time in warm water with little oxygen content.

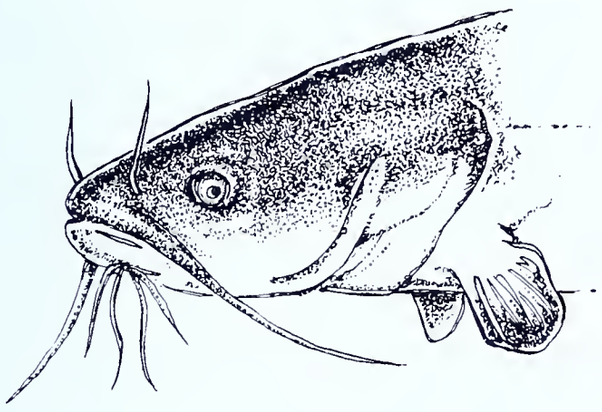
The bullhead often is mistaken for the channel catfish, even though the two are dissimilar in several ways. For one thing, the bullhead cannot begin to approach the size of a channel catfish. Average size for a bullhead is 12 to 15 inches; 18 inches and three pounds is about the absolute tops. The tail of the bullhead is straight or slightly rounded, not forked as in some other catfish (See *Figure Six).* The adipose fin is present, but scales are absent as they are on all catfish. Characteristic of this family, the bullhead is protected with a sharp spine in the dorsal and pectoral fins. In the brown bullhead this pectoral spine features several heavy barbs on its rear edge. The black bullhead on the other hand, has weak barbs on this spine, and the yellow bullhead has barbs that are more numerous and stronger than either of the other two.

Coloration of the bullhead varies from a brown to olive-green on the brown bullhead, to brownish-black on the black bullhead, and yellowish to brown with a yellow belly on the yellow bullhead. The belly on the black and brown bullhead is gray to yellowish. The sides of each are often mottled. Eight barbels surround the mouth and these range in color from grayish-black on the brown bullhead to black (black bullhead) and whitish (yellow bullhead).

Reproduction of the various bullheads is very similar, occurring in the spring. The female and male cooperate in constructing a redd, which is usually a saucer-shaped depression. The bullhead will sometimes burrow in the bank of the stream or lake, usually in a sheltered area, or even use an existing cavity in which to deposit the eggs. The adhesive eggs appear as cream-colored clusters and are closely guarded. Parental concern also is evident as each takes its turn in keeping the eggs aerated with a constant swimming motion. The eggs are worried over by the anxious parents which even have been observed taking the egg into the mouth, carefully cleansing it, only to blow it back into the nest where it settles into position with the balance of the family-to-be. After hatching, close parental supervision is provided until the young bullhead fry is about one inch long.

Active at night, the bullhead uses its barbels to help locate prey and other food. It is a bottom feeder which will take insect larvae as the major portion of its diet. Minnows, worms and bits of plant material also contribute to its daily intake.

The bullhead is often utilized by fishery managers as forage for other gamefish, especially the largemouth bass. It is fun to catch with light tackle and its lightly tinted, orangish pink flesh is quite acceptable on the table.



Although placed at the same location around the mouth on all catfish, the barbels on the various bullheads differ in color:

Brown bullhead — grayish-black

Black bullhead — black

Yellow bullhead — whitish

Burbot
Lota lota

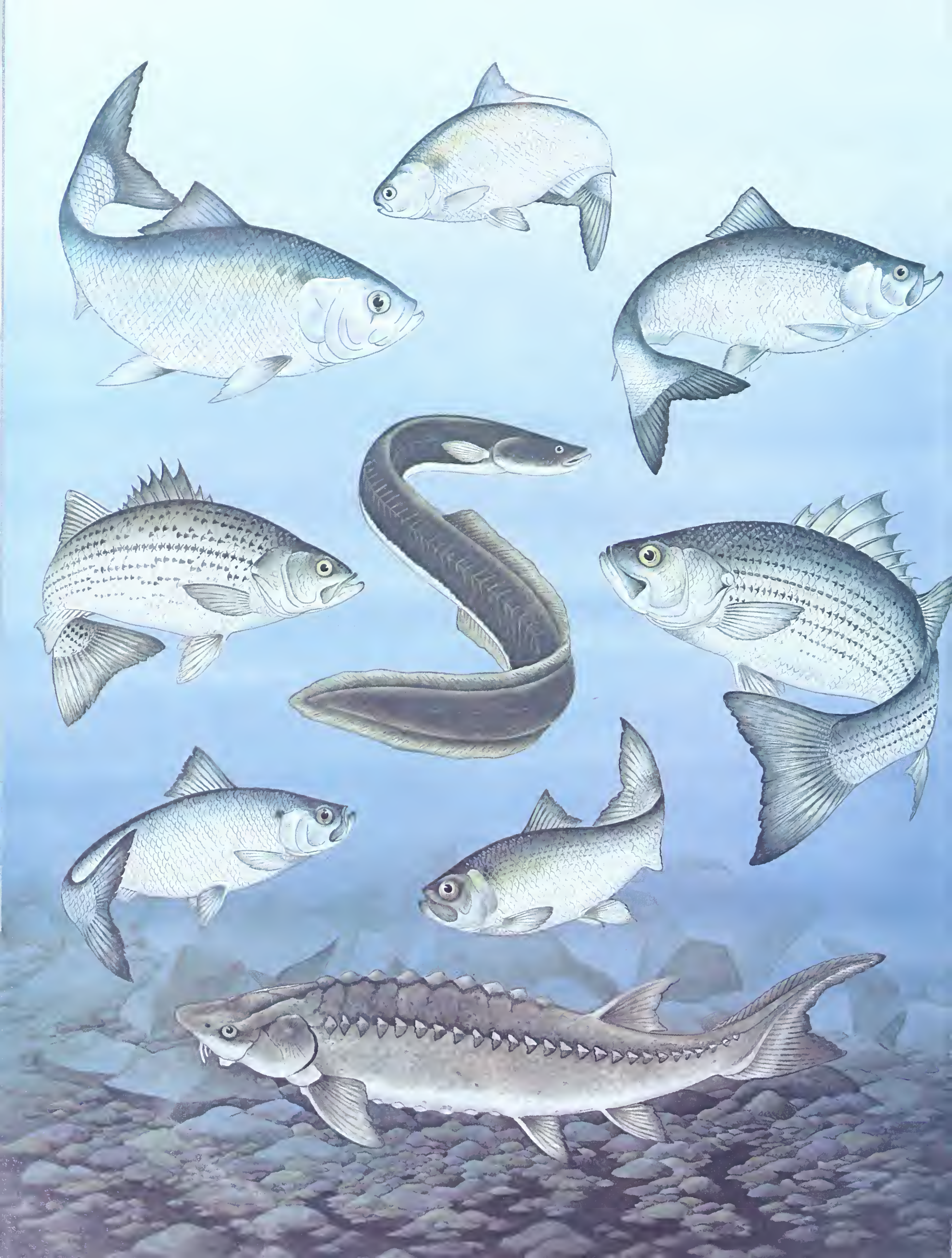
10. This freshwater cod is a bottom dweller of some of our waters in the northwestern portion of the state. It is more abundant in the upper Allegheny River watershed than other areas, although even here, not reported in large numbers. The burbot, the only freshwater species of a marine family, usually is found in very deep, cold waters. In Pennsylvania, maximum size is probably about 30 inches, reaching a weight of eight to 10 pounds; larger sizes have been reported in other areas of its range which includes much of North America extending southward to the Great Lakes.

The body of the burbot is long and slim, tapering to a point at the tail. Two dorsal fins are placed on the back, one short, the other very long and extending perhaps half the body length to the tail. The anal fin is nearly the same shape and length as the longest dorsal fin. A single barbel is set on the tip of the chin. The back and sides of the burbot are grayish olive to a dark bronze color. Irregular pale blotches tend to break up any uniformity of the background color. Minute, nearly indiscernible scales cover a heavy skin.

The burbot is unusual in its habit of spawning in the middle of winter. The peak spawning activity occurs in early February when the burbot runs into streams, often under ice, to scatter its eggs over a sand or gravel bottom. Deposition of the non-adhesive eggs usually takes place at night, after which the adults depart, providing no further care.

The burbot begins life feeding on immature aquatic insects, gradually beginning to take larger prey such as crustaceans and later, fish. Fish make up most of the diet of the adult burbot.

The flesh of the burbot is white and flaky and is thought by many to be good eating. Smoking is a favorite method of preparing the freshwater cod.



Migratory Species

American Shad

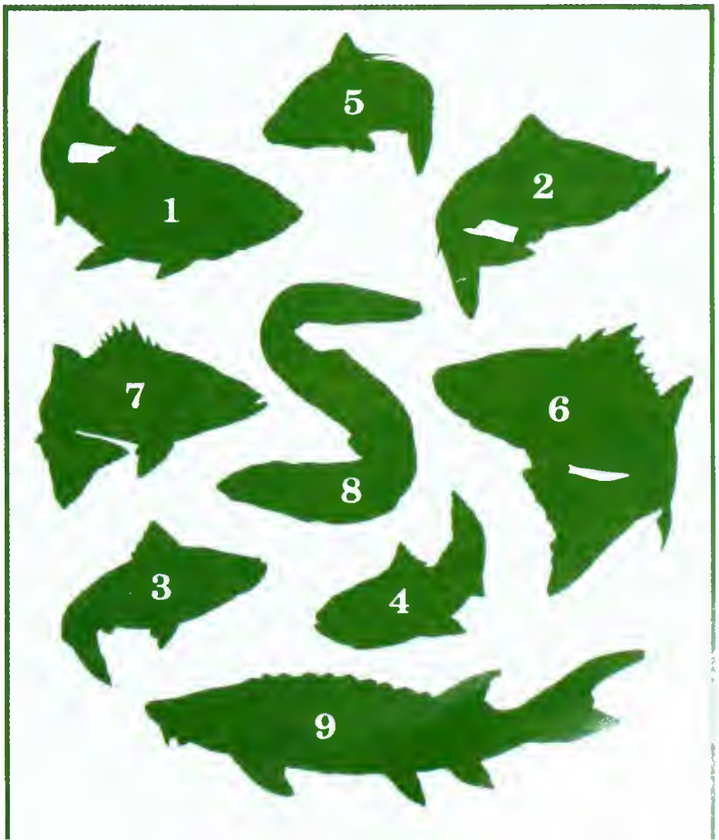
Alosa sapidissima

1. Perhaps no other fish, migratory or permanent resident in Pennsylvania waters, has been written about more in history, or has a more colorful background or caused more people to stand up and be counted, than the American shad. History books tell us the American shad, making its annual spring migratory run, arrived just in time to help save General Washington's troops from starvation while encamped at Valley Forge. The American shad was later to sustain an important commercial fishery, and we still hear stories of shad being netted in the Susquehanna River, loaded into horse-drawn wagons filled with water and peddled through the streets in the borough of Columbia and other nearby towns. But that industry soon vanished when huge concrete barriers were constructed between the picturesque wooded hills on either side of the lower Susquehanna River. Hydroelectric power had come to Southcentral Pennsylvania. But almost from the very beginning, a battle has been waged to restore the natural migratory run of the American shad to its ancient spawning grounds in the upper reaches of the Susquehanna River watershed.

In Pennsylvania, the Delaware River now is the only major watershed entirely accessible to the shad and other migratory fishes entering fresh water from the ocean. The Schuylkill River is making at least a partial comeback, thanks to a fishway constructed at the Fairmount Dam in Philadelphia. Plans call for other fishways to be built at additional dams upstream from Philadelphia that will provide these transient fish access to more spawning areas. In the meantime, efforts to restore the shad to the Susquehanna River, the state's largest watershed, continue on several fronts. The Pennsylvania Fish Commission operates a shad hatchery on the Juniata River where each spring shad eggs are hatched. The young shad are planted in the Juniata River which serves as a nursery area prior to their autumn migration to sea. Adult shad also have been transferred successfully into the watershed from several East Coast rivers. In addition, a trapping operation at the base of the Conowingo Dam in Maryland, the first obstacle faced by the shad in their upstream journey, provides another source of these fish for transportation to points farther upriver.

The American shad is the largest of five members of the herring family to live at least some part of their life cycle in Pennsylvania waters. A female American shad, taken at the height of the spring spawning season, could average four or five pounds. Even a six- or seven-pound female would not be considered exceptionally unusual. The male will average slightly smaller than his female counterpart. The American shad is silvery on the sides with light olive to bluish shades over the back. There usually is a single horizontal row of several dark spots located behind the gill cover. No teeth line the jaw, set within a delicate mouth. In fact, the soft mouth has freed many anxious shad from an angler's lure as the fragile tissue gives way to the thrashing of this much respected fighter. A characteristic peculiar to all members of the herring family, the underside of the shad's body is accented with a saw-toothed edge formed of belly scales. The dorsal fin is short and set at about midpoint on the body; the tail is deeply forked.

Like other herrings, the American shad is anadromous, meaning it returns to freshwater rivers from the oceans to spawn. The American shad will travel farther upstream than other members of its family, returning to spawn in the river in which it was born. The surge upriver is triggered when the water temperature reaches 50 to 60 degrees, with the lower readings preferred. The males will precede the females into the river and thus become an early signal to anglers that the major part of the run is about to begin. Female shad will often pair with more than one male during the same spawning season. The American shad, unlike the hickory shad, prefers the main part of the river and will seek out sand bars or stony riffles over which the eggs are loosely broadcast. Deposited in moving water, these semi-buoyant, non-adhesive eggs will drift until they hatch. The new shad will appear in six to 10 days, depending on water temperature. The American shad produces a very large number of very small eggs, upwards of 100,000 on the average, with as many as 200,000 to 300,000 known to be deposited by a single female. Left to the whim of the river, the drifting eggs



receive no attention from the adult shad. The young shad cruise the freshwater rivers and streams for several months, departing for tidewater and the deep ocean in late fall to early winter. The juveniles will spend three or four years maturing in salt water before returning for the first time.

The shad feeds primarily on micro-crustaceans, but will also take insects as part of its diet. Worms and small fish will be used occasionally to supplement its regular fare.

"A fury of aerobatic maneuvers" might be an appropriate description of the American shad. The American shad has a reputation among anglers as being a dynamo of strength and vitality. No longer thought of as strictly a commercial species, the shad provides thrilling sport for a growing number of anglers. A very palatable fish on the table, the shad — especially planked shad — is a gourmet treat; its flesh is sweet, with a delicate flavor. The roe particularly, is considered a delicacy.

Hickory Shad

Alosa mediocris

2. In many respects, the hickory shad parallels the American shad, particularly where its demise in the Susquehanna River is concerned. Historically, the hickory has been less abundant in the Delaware River than the American shad. But in the Susquehanna River in the past at least, it was extremely plentiful, entering that big river from the Chesapeake Bay, its major population center. The hickory shad begins its migratory run before the American shad and thus is seen by anxious river watchers earlier. Sightings of the hickory shad in the lower estuary sends anglers scurrying for their fishing rods in anticipation of the larger (and possibly more preferred) run of American shad.

The hickory is bluish silver on its sides, shading to a somewhat darker gray-green over the back. A row of five or six dark spots appear high on the fish's sides, extending rearward from behind the gill cover. The long projecting lower jaw differs from the American shad whose lower jaw does not protrude quite so much. Somewhat thinner than the American shad, the hickory shad will average one to three pounds. Again, the scaled sawtoothed edge is apparent on the belly of the hickory shad as it is with other members of its family. The hickory shad exhibits the deeply notched tail, inherent to the herring family.

The hickory shad does not venture as far upstream as the American shad, preferring to spawn in tidal fresh water. Although not much is known about the spawning habits of the hickory shad, it appears the juveniles quickly move downstream, entering brackish estuaries where they remain for the duration of their first summer.

The hickory shad is considered more of a fish-eater than the American shad. All the same, it won't turn away from small crustaceans and even squid.

The hickory shad is a popular sport fish and is considered to be every bit the fighter as the American shad.

Blueback Herring

Alosa aestivalis

3. Another member of the herring family, along with the American shad and hickory shad, the blueback herring displays most of the characteristics associated with the rest of this family. Its habits, physical traits and habitat preferences vary little from the other anadromous herrings. Its range extends from as far north as Nova Scotia south to Florida. In Pennsylvania, the blueback herring returns to the Delaware River when the time has come for it to seek out its home spawning beds.

The blueback herring often is mistaken for its cousin, the alewife, but comparisons will show the blueback to be more slender. It is also a darker shade in color than other members of the family even though the silver sides are still quite evident and the back maintains its bluish cast. The blueback herring has just a single dark spot located behind the gill cover. The center of the tail is deeply indented and this, along with the short, center-positioned dorsal fin helps identify this fish as a member of the herring family. The blueback herring is not a big fish, averaging less than a pound in weight; 15 inches would be about the maximum length.

In most instances, the blueback herring is mature and prepared to spawn by its fourth year. It is one of the last to migrate toward the mouths of freshwater rivers, arriving in late spring after most other anadromous herrings. Like the American shad, the blueback will venture far above tidewater in search of swift tributary streams in which to spawn. It is selective in choosing its spawning site, looking for a firm bottom in the river system over which to spread its adhesive eggs. After hatching, the young bluebacks spend most of their first summer in fresh water before heading out to sea.

The young blueback herring feeds chiefly on zooplankton, taking progressively larger food as he grows until shrimp and fish become his main staple.

Alewife

Alosa pseudoharengus

4. Although anadromous, the alewife can easily adapt to large freshwater lakes, reproduce there and swell to become a substantial colony of forage fish for large predators. A school fish, the alewife prefers open water and thus becomes a natural target for such deepwater fish as salmon and striped bass. This ability to accept something other than its natural habitat has caused the alewife to extend its range from the Atlantic Coast to the Great Lakes. Large populations of the alewife often suffer massive summer die-offs related to changes in water temperature. Unfortunately, this phenomenon is often quite visible, especially along the shores of several of the Great Lakes. It is during these moments that we witness nature at work, keeping things in their proper balance.

The alewife is a small anadromous herring and like the blueback reaches a maximum length of about 15 inches. Landlocked alewives rarely exceed nine inches. It is bluish above and bright silver on the sides as are all

the herrings to one degree or another. The alewife has a faint dark stripe along either side and a single blackish spot behind the gill cover. Its scales are large and easily shed.

The alewife will spawn in lakes or streams, preferring quiet areas with little movement. Spawning occurs roughly two to three weeks before the American shad. The eggs are spread randomly over the bottom where they will stick to gravel and rocks until such time as they hatch.

The alewife feeds primarily on zooplankton and other minute organisms, gradually beginning to take fish eggs and finally some crustaceans as they become large enough to handle more bulk.

Gizzard Shad

Dorosoma cepedianum

5.The gizzard shad, although a member of the herring family, differs in several respects from its cousins, genus *Alosa*. Its common name provides us one clue — the gizzard-like stomach of this species sets it apart from others of the herring family. Usually confined to fresh water, the gizzard shad is found in most of the eastern two-thirds of the United States. Primarily a fish of slow moving water, it can be found in several lakes and ponds and the backwaters of slower streams throughout most of Pennsylvania. A school fish, the gizzard shad likes open water but is not considered a migratory fish; it will not range far from its normal habitat.

The gizzard shad is silvery in color, bluish above but with a brassy to reddish cast appearing almost as a reflection on its sides. Its dorsal fin differs from other herrings and is useful in distinguishing it from others of the family when several may appear in the same habitat. Although short and set midway on the body as other herrings, the dorsal fin of the gizzard shad has its last ray elongated, extending far over the back and well beyond the rest of the fin, trailing like a filament.

Spawning time for the gizzard shad is in the spring, anytime from April through June, depending on water temperatures. The gizzard shad spawns in large schools, moving in close to shore to find roots and other debris over which the adhesive eggs will be scattered. Gizzard shad experience rapid growth and will reach a maximum size in Pennsylvania of about ten inches.

The gizzard shad feeds somewhat differently than others of the herring family. Described as a filter-feeder, it will strain out and use small organisms from the mud. Most of this matter is plant material and organic debris which will be ground up in the gizzard-like stomach, a unique method of digestion among fish. The gizzard shad thus converts organic material to fish flesh, becoming an efficient and effective forage fish and an important prey for striped bass and other game fish.

Striped Bass

Morone saxatilis

6.The striped bass, also commonly called "rock fish", is an important marine game fish now found in several inland lakes in Pennsylvania. In some cases, the striper has been crossed with the white bass to produce a striped bass hybrid that also has adapted well as a landlocked species. The striped bass was originally common along the Atlantic Coast from the St. Lawrence river extending south to Florida and even into the Gulf of Mexico. Its value as a food fish goes back to the first settlers when Plymouth colonists were fed by the striper during the summer months beginning as early as 1623. No less a personage than Captain John Smith wrote of the eating qualities of the striped bass.

The striper is primarily anadromous, although in its migratory form today is restricted in Pennsylvania to the Delaware River where a major fishery is developing as pollution control measures continue to improve water quality. Other times saw large runs of the rock fish from the Chesapeake Bay into the Susquehanna River. But with the construction of dams, their routes to native spawning grounds blocked, the striper today is found in fewer numbers in the Chesapeake and its freshwater tributaries.

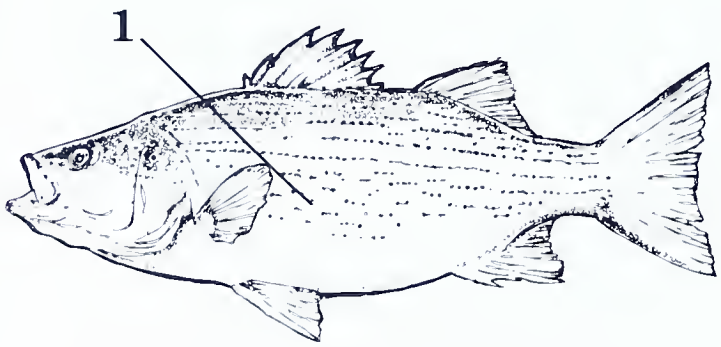
The striped bass is easily recognized from most other forms of marine fishes. Its back is olivaceous to steel blue, almost black. The sides are silvery, shading to white on the belly. Usually seven or eight black lateral stripes run the length of the body. They are well pronounced, heavy and distinct and are unbroken from the gill to the tail (different from the hybrid). The two dorsal fins, one spiny, the other soft-rayed, are separated and about equal in length. The back of the tongue has two tooth patches which may be used to help distinguish this fish from the white bass. The body of the pure striped bass is slimmer and more streamlined compared to the striper hybrid, at least until it reaches a weight of five to ten pounds when it begins to fill out.

The striped bass spawns in the spring near the mouths of the larger rivers, but usually above any tidal influence. The male begins to mature at two years of age, the female maturing a bit later at about her fourth year; she'll be 18 to 24 inches long by that time. Individual fish may continue to spawn yearly until ten to 14 years of age. Water temperature is an important factor in determining when actual spawning activity will begin. Whereas some spawning may occur at 55 degrees, the peak will be reached when water temperatures are in the 60- to 67-degree range. Spawning begins when several males surround a single large female. They appear as though engaged in battle, their swimming marked with frantic movements, but all just a part of the spawning ritual. When spawning occurs, the younger female may release 65,000 eggs, an older fish as many as five million. The semi-buoyant, greenish-colored eggs are released over stony riffles to drift with the current during incubation. No care is provided by the parents and they will hatch in two to three days, depending on water temperature. The yolk sac will be absorbed by the young striper in about six days. Soon afterwards, the juveniles will make extensive use of the estuaries as a sort of nursery area, while the adults prefer the open waters along the coast. Because

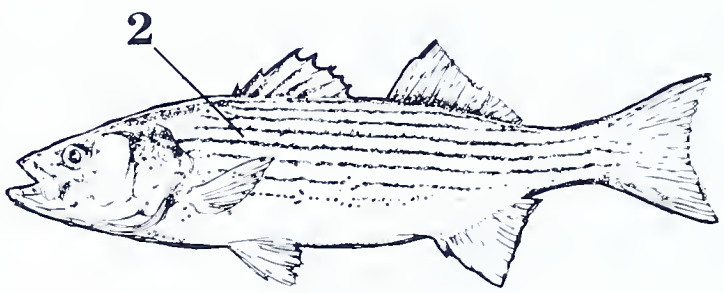
the eggs must remain suspended in moving current prior to hatching, there is little or no natural reproduction in reservoirs and other impoundments into which the striped bass has been introduced.

The striped bass is a voracious feeder. The first food taken after the yolk sac has been absorbed consists of zooplankton. The young striper then takes a variety of invertebrates till, as an adult, fish and crustaceans become the mainstay of its diet. The rock fish feeds most actively at night.

The striped bass is rated very highly as a sport fish. Trolling probably accounts for most of the striped bass that are caught, although drift fishing with live bait may be just as effective at certain times of the year. In the spring and again in late summer through fall, anglers often spot a school of stripers working over a large school of forage fish. Silver spoons thrown into this foray often bring dramatic results. Striped bass experience a rapid rate of growth and catches of 15 to 20 pounds are not uncommon in Pennsylvania.



Striped Bass/White Bass Hybrid



Striped Bass

The body of the hybrid striped bass usually is stockier than the striped bass; the hybrid's stripes are broken and less distinct (1) than the heavier stripes running unbroken from the gills to the tail on the pure striped bass (2).

Striped Bass/White Bass Hybrid

Morone saxatilis & Morone chrysops

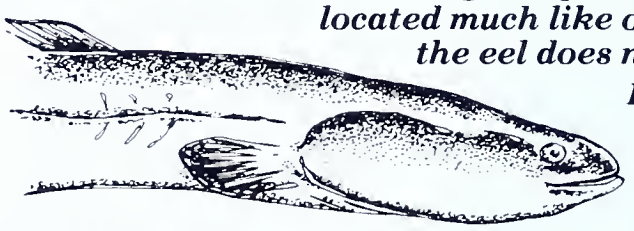
7.The biological combining of the striped bass and white bass has to be considered one of the most exciting and successful products of fishery biologists in recent years. The marrying of the two basses has produced a hybrid whose growth rate is even faster than that of the pure strain of striped bass, and although it will not match its proportions, is more gamey than the striper. The striper hybrid has adapted well in lakes of varying sizes and in large rivers. Stocked in larger inland lakes and in some of our major river impoundments, the striped bass hybrid is an effective predator as it helps control the populations of gizzard shad and the alewife.

The body of the striped bass hybrid is deep; it is stockier than the white bass and most striped bass weighing under eight to 10 pounds. Like the striped bass, the back of the hybrid is dark, almost black, with silvery sides and white belly. The lateral lines on the hybrid number seven or eight as they do on the striper, but are less distinct. They are usually broken, rather than running uninterrupted from the gill to tail as on the pure striped bass. The two dorsal fins are separated, a mark of the true basses. Two tooth patches appear on the rear portion of the tongue and may be used to help separate this hybrid from the white bass which has only one tooth patch. The striped bass hybrid rarely exceeds ten pounds.

The striped bass/white bass hybrid is probably sterile, characteristic of most hybrid species. There have been no known records of natural reproduction taking place.

The striped bass hybrid is every bit the voracious feeder as its purebred parent, perhaps more so according to some anglers. It is an effective fishery management "tool" since, like the rockfish, the hybrid is an open water fish and thus is available to help control populations of gizzard shad and the alewife. Angling methods for the hybrid parallel those of the striper.

Although its pectoral fin is located much like other fish, the eel does not have a pelvic fin.



American Eel

Anguilla rostrata

8.Of 16 species of eels found in North America, only the American eel claims Pennsylvania waters as its home. A migratory fish, the eel is classified as catadromous, meaning it spends its life in fresh water, returning to salt water to spawn. The eel dies soon after spawning has been completed. For a long time, scientists did not know exactly where the spawning beds were located. But continued studies of this peculiar-looking fish revealed only recently, that annual migration runs were made to waters deep in the Sargasso Sea, an area in the Atlantic Ocean near Bermuda.

In Pennsylvania, the eel is found in the Delaware River and Susquehanna River watersheds. The eel is able to travel the entire length of the Delaware since no

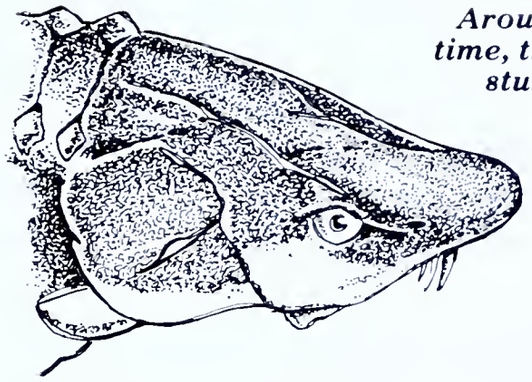
dams block its upward migration. Unfortunately, such is not the case on the Susquehanna River where several dams impede the efforts of this important game and food fish to enter the upper reaches of the basin. To compensate, the Fish Commission has stocked eels at several points above the dams. In most cases, the eels were collected as elvers — juvenile eels measuring five to six inches — at the mouths of rivers and transported upstream by truck. As a result, adult eels continue to be found throughout much of the Susquehanna watershed. The eel has thus become more or less landlocked, as efforts to restore a natural migratory run in the Susquehanna River continue.

Under normal migratory patterns, as on the Delaware River, the female American eel moves far upstream, traveling mostly at night. The male usually will remain in the estuaries, or on occasion, enter the extreme lower reaches of the river. The trip from the spawning beds is a long one. By the time the juvenile eel reaches the mouth of the river which is to become its freshwater home, it has been on the move for one year. For all intents and purposes, due to its body structure, the young eel is transparent until it reaches the relative safety of the rivers. But this being almost "invisible" may help provide a safe journey through vast ocean waters from its far-away birthplace.

The eel is long and slender in appearance (some people would even say snake-like). It varies in color from yellowish brown to olive, the darkish hues covering the entire body. Although the American eel appears to be very smooth and scaleless, almost slippery, close inspection reveals a protective covering of very small, almost indistinguishable scales. The head of the eel tapers to a small mouth; its lower jaw protrudes slightly. The dorsal fin is low, not projecting very far above the back of the fish, and long. It connects to the tail and continues around the tail to form the anal fin. The American eel does not have a pelvic fin. In Pennsylvania, the maximum length is usually two to three feet, although it is possible an angler may catch one measuring longer. The female will grow to a larger size than the male.

The eel usually feeds at night, taking a variety of food including crayfish for which it has a special fondness, small fish, worms and especially aquatic insects which make up a major portion of the eel's diet.

Eels have been an important commercial fish since before the turn of the century, although the number of eels harvested in this manner today is much less than in days gone by. The eels were caught during their fall migration toward the sea with the help of eel racks, or chutes. These essentially were barricades constructed of large stones and usually placed in the middle two-thirds of the river. The remains of these eel racks are still visible in some larger streams and rivers. They appear as low, long, V-shaped wing dams, with the widest opening on the up-river side. Today, eels still are harvested to a small extent by commercial fishermen using nets. Their primary importance today, however, is the sport they provide anglers fishing with hook and line. They are considered a very palatable fish, especially when smoked over hickory wood.



Around for a long time, the shortnose sturgeon now is endangered.

Shortnose Sturgeon

Acipenser brevirostrum

9.Few in number, the shortnose sturgeon is classified as ENDANGERED. Because of this, the possession or killing of a shortnose sturgeon is prohibited by law. In Pennsylvania, the anadromous sturgeon is a visitor to the Delaware River estuary, returning briefly in the spring.

That the shortnose sturgeon had to be placed on the "List of Endangered Species" is bad enough, but it is especially sad when you consider the amount of time this fellow has been around. The shortnose sturgeon can trace its roots back to early geological history. It is a modern relic of the earliest bony fishes. Many of its structures are quite primitive — the skeleton is largely made up of cartilage rather than bone — indicating this to be a survivor of an ancient family of fishes. Five rows of bony plates cover the body. These same plates also shield the head, and thick bony scales cover the tail.

The tail of the shortnose sturgeon reminds one of a shark's tail, appearing as though turned up. Scientists refer to it as being heterocercal, which is a fancy way of saying the lobes are not the same size. In the case of the shortnose sturgeon (or the shark) the upper lobe of the tail is much longer than the lower. The shortnose sturgeon is olive green or brownish in color, darker above, turning paler below. It is the smallest of the three sturgeons in its immediate family, growing to a maximum length of two to three feet.

The shortnose sturgeon matures at four to six years of age when it will return to the river system to spawn, passing upstream during peak flows which occur from April through early June. It will rarely venture far upstream, remaining in tidewater where small, dark brown eggs will be deposited over rubble or gravel beds. The eggs receive no care from the adults who usually return to the sea after spawning has been completed. The shortnose sturgeon generally lives longer than other species, perhaps surviving for 50 to 60 years or more.

The shortnose sturgeon is well equipped and adapted for feeding on the bottom. Its snout is shovel-shaped, under which there is a sucker-like mouth which can be made to protrude. Four barbels, located in front of the mouth, also aid in locating food. In short, here is an efficient tool to work over the floor of the Atlantic coastal waters and river bottoms in search of sludgeworms and other organisms residing on the bottom. It will also feed on small crustaceans.

Panfish Species

White Bass

Morone chrysops

1. Belonging to a marine group that includes the sea basses and groupers, the white bass is only one of two true basses that inhabit fresh water. The largest populations of this species is probably found in the Mississippi River system and the Great Lakes. As a native in Pennsylvania, the white bass was limited to several western counties and was most abundant in Lake Erie and the Allegheny River. Now, though scattered, the white bass is found throughout the state in lakes as well as larger rivers.

The white bass is a medium-sized fish, filling that gap somewhere between the white perch and the striped bass and striped bass hybrid, all members of its immediate family. Maximum size is in the neighborhood of 18 to 20 inches; a two-pounder would be considered a trophy. The body of the white bass is deeper than the striper, the back more arched. There is a relative lack of body stripes compared to the striper or striper hybrid, with only one black stripe reaching from the gill to the tail. The balance of the stripes are faint and at times almost unseen. The first of two separated dorsal fins is spiny and there are three spines on the anal fin. The tail is forked, typical of this family.

Only once in about every three or four years will an individual white bass successfully reproduce. Whenever possible, schools of white bass will migrate upstream to spawn over rocky shoals in six or seven feet of water. The white bass appears to return to the same shoal or gravel bar each spring in search of a mate. Actually, several males will attend to one female during the spawning ritual which takes place in late April to early June. No nest is prepared and no care is given to the 25,000 to 1,000,000 eggs that each female will release in the current. Spawning activity develops in water temperatures of 58 to 64 degrees, and the eggs subsequently will hatch in two to three days.

As an individual, the white bass is voracious in its appetite. As a compact school of fish it can be exceptionally ravenous. Early in life, white bass fry swimming in huge schools seek out zooplankton, consuming large amounts of these tiny organisms. Later, increasingly larger prey is sought and insects and crustaceans and finally fish become a staple of these hungry masses. Wherever available, gizzard shad make up a large portion of the diet.

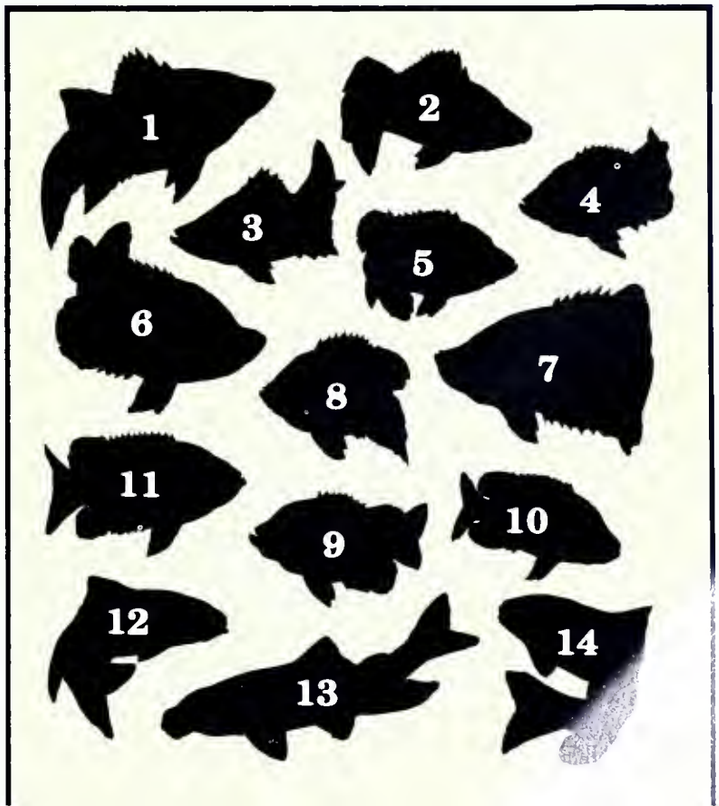
The white bass is fairly easy to catch. Just keep in mind they usually are in deep water by day and in the shallows at night. The white bass also is considered good table fare.

Yellow Perch

Perca flavescens

2. One of our most popular panfishes, the yellow perch is native to a broad area of Pennsylvania. It is abundant in many lakes and is especially popular in the northeast and northwest counties. Lake Erie has supported a commercial fishery supplying yellow perch to markets and restaurants for years. Happily for anglers, the yellow perch adapts well to any new environs meeting its habitat requirements and thus has flourished in many new impoundments outside its original range. As a result, numerous lakes throughout the state now offer outstanding yellow perch fishing where none previously existed. Although basically thought of as a lake fish, the yellow perch sometimes may be found in a sluggish stream. A good perch lake would be described as one having a rocky bottom with moderate vegetation; it would have plenty of open waters that remain clear and cool the year round.

Since both are classified in the perch family, the yellow perch and walleye can be considered close cousins. But in spite of the similarity in names, the yellow perch and white perch are not related. The white perch is a true bass, belonging to the same family as the striped bass.



The yellow perch is a colorful and attractive fish, a good photographic subject just out of the water. Its body is yellowish gold to green and the back is dark, somewhat olivaceous in color. Six or seven dark vertical bars or blotches follow the curve of the body from the back downward to near the white belly. The lower fins are red or orange and especially brilliant in the spring. The two dorsal fins are separated; the spiny-rayed fin is set forward and usually marked with a black spot at the base. The anal fin features several well-defined spines. Unlike the walleye, the yellow perch is not armed with canine teeth although the mouth is generously lined with a great many fine teeth.

The yellow perch spawns early in the spring soon after ice is out and about a week after the walleye has spawned. Spawning usually occurs at night when the water temperature is 45 to 50 degrees. The method utilized by the yellow perch in depositing its eggs is unusual, especially within the perch family. It doubtlessly has caused wonder among many anglers who have seen the eggs in shallow water, not knowing what they were. The eggs, imbedded in a gelatinous-like substance appear as long ribbons or accordian-like masses of jelly draped over submerged vegetation and brush. As many as 10,000 to 75,000 eggs may be included in a single string of this translucent jelly, protected there until they hatch two to three weeks later. The parents provide no further protection. Even so, a good percentage of the eggs will successfully hatch, but mortality afterwards is high. The young yellow perch congregate in large schools and as slow swimmers, are easy targets for a variety of predacious fish, especially walleye.

The yellow perch subsists on aquatic insects while still young, eventually takes crustaceans and as an adult thrives mostly on small fish. The yellow perch is most active during the day and contradictory to the walleye is by and large inactive at night.

The yellow perch is easily caught by most anglers and is a popular and scrappy sport fish. It is the subject of scores of anglers who also recognize the yellow perch as one of our most palatable fish. Its flesh is white and sweet and a delectable morsel prepared in any number of ways.

White Perch

Morone americana

3. The white perch is a native to the Atlantic Coast. In Pennsylvania, this smallest member of the true basses principally was found in the Delaware River and to a lesser extent in the lower Susquehanna River basin. They are becoming more abundant in Lake Erie. Primarily a resident of brackish water, the species has adapted to freshwater landlocked lakes in several areas. However, their tendency to overpopulate a lake, coupled with their slow growth detracts from their ability to provide a suitable fishery. It is gregarious and as a member of a large school will move to deeper water during the fall and winter months.

The white perch does not resemble the yellow perch and in fact, is not even a member of the same family. The white perch is silvery on the sides with possibly vary faint streaks. Otherwise, the sides are unmarked. The back is olivaceous to a dark blackish green and the belly is white. Two dorsal fins, although they appear to be separated, actually are joined at the very base; one is spiny, the other soft-rayed but even it has one spine in its forward ray. The soft anal fin has eight to 10 rays compared to the 11 or 12 on the white bass and striped bass. The body of the white perch is high-backed, arched even more than the white bass and much more than the striped bass. In Pennsylvania, a white perch of a pound and a half would be considered a nice trophy.

The spawning habits of the white perch simulate others of its family. From the Delaware River estuaries, the white perch migrate upstream to spawn in fresh water. No nest is prepared and after spawning is completed, the parents swim away, leaving the eggs and subsequent fry alone in their environment. A one-pound female may deposit as many as 150,000 eggs which adhere to anything they touch as they drift downward. The eggs will hatch in a few days.

White perch relish aquatic insects, especially mayfly nymphs captured as they emerge from their home burrowed in the stream bottom. As the white perch gets older, however, small fish and crustaceans are added to the diet.

Anglers find the white perch easy to catch, especially with a worm-baited hook. They are a well accepted staple to anyone's list of seafood.

Redear Sunfish

Lepomis microlophus

4. The redear sunfish is rare in Pennsylvania, having been introduced into only a few lakes, and anglers will see this sunfish only seldom. Its native range is to the south and west of the state. It is an inhabitant of warm, clear lakes with profuse amounts of vegetation or where other cover such as stumps and logs may abound.

The redear sunfish gets its name from the brilliant orange or red tip on the gill cover. The balance of the body is a very bright olivaceous color with a yellow or orange breast. Darker olive-colored spots may appear on the sides; the belly is brassy in color. The lack of any spots on the dorsal fin and lack of blue bands on the head differ from the pumpkinseed which this fish closely resembles. Molar-like teeth line the mouth and are handy tools when it comes to feeding.

The redear, mature in its second year, spawns in May or June. Similar to the bluegill in habits, nests are built in colonies. This fish is less likely to travel in schools, however, except during the spawning period. They are not as prolific as the bluefill and thus less likely to overpopulate a lake. Farm ponds may benefit from utilization of the redear sunfish.

Snails make up a major portion of the redear's diet. It will feed on insect larvae, but insects make up less of its diet than might be the case with other species. Therefore, it does not compete to any great extent with those fish considered insect-eaters. The redear does not often come to the surface to feed.

Highly palatable, the redear is a desirable species but difficult to catch, primarily due to its feeding habits.

Live bait seems to work best; lures seldom bring any response.

Pumpkinseed

Lepomis gibbosus

5. The pumpkinseed is recognized as one of our more common sunfishes. Distributed throughout the Atlantic drainage and the upper Mississippi watershed, the pumpkinseed thus enjoys statewide popularity in Pennsylvania. Able to adapt to a variety of habitats, the pumpkinseed might be caught by anglers in streams as well as lakes and ponds. It likes shallow water, especially if it is quiet and clear. The pumpkinseed generally will live in cooler water than others of the immediate family, and it has a special interest in dense vegetation. It can tolerate poorer water quality than many other species, successfully sustaining itself through periods of low oxygen, low pH or high turbidity. Still, it is more often found in open water than other sunfish.

This is one of the smallest sunfishes, an eight-inch fish being better than average; nine to ten inches is about the maximum length attained. The body of the pumpkinseed is light olive in color, shaded with blue and with variously colored spots on the sides. The cheeks and gill covers sometimes are marked with wavy, light blue bars. The belly shows a hint of orange. The gill flap is rather small and rigid, and it is edged with orange or red, nearly scarlet. These features, along with the dark spots on the soft-rayed dorsal fin help identify the species. The pectoral fins are long and pointed compared to other sunfishes.

The pumpkinseed spawns in late May to early June, but unlike the bluegill, does not nest in large colonies. The saucer-shaped nests, only one to three in a group, each receive several thousand eggs. They are deposited there by several females enticed to use the nest by a single male. It will take five to 10 days for the eggs to incubate and each nest may produce as many as 14,000 fry. Those that survive will mature in about two years. The male protects his progeny from golden shiners and other predators.

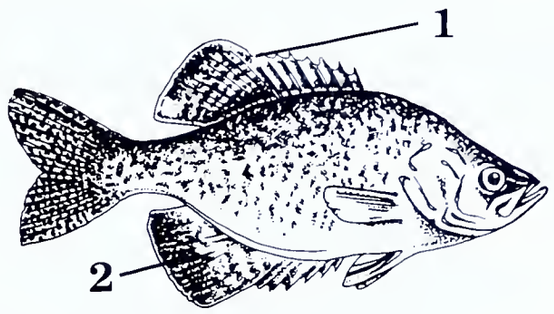
Feeding time for pumpkinseeds can be almost anytime, but it is especially active during the morning and evening hours. It will take a variety of invertebrates, snails being a favorite.

This small, colorful sunnie has provided many a novice angler with his very first catch. Aggressive, the pumpkinseed is great sport on light tackle and is a favorite of anglers of all ages.

Black Crappie

Pomoxis nigromaculatus

6. The black crappie is one of Pennsylvania's largest panfishes. It is one that also covers a wide geographical area of the state. The white crappie is a close relative, but less common. The black crappie will be found in large streams and impoundments, showing a partiality to those with clear water and a generous sprinkling of aquatic vegetation. The black crappie is a bit more finicky than the white crappie in choosing its habitat, wanting water that is cleaner, deeper and cooler. The crappie is a gregarious creature and almost always travels in schools, a distinct advantage for anglers. It is known by several other names, calico bass, crappie bass and papermouth, owing to its delicate mouth tissues.



Black Crappie

The black crappie has seven or eight spines in the dorsal fin (1), the white crappie five or six. The black crappie anal fin is marked as shown here (2), the white crappie anal fin is unmarked.

The body of the black crappie is deep in proportion to its length when compared to the white crappie. Eight to 11 inches is a common size, maximum would be about 15 to 16 inches, and it will range in a weight class of one to two pounds. The black crappie is silvery to goldish on the sides and back, with a mottled dark green or black pattern usually in the form of a series of irregular spots. This mottled effect is apparent on the side of the body as well as on the dorsal, anal and caudal fins. Five or six spines fortify the anal fin and seven or eight spines are included in the dorsal fin. The white crappie has only five or six spines in the dorsal fin, and this feature can help separate the white and black species. The snout of the papermouth appears to project forward, and is especially apparent when the mouth is closed.

The black crappie spawns in May or June when the males construct shallow nests over roots of aquatic plants or among other types of dense cover. The nests can be numerous and are crowded into colonies, generally in three to six feet of water. Mature at two years of age, a half-pound female may produce from 20,000 to 25,000 eggs. The nests and eggs are courageously defended by the parents.

The black crappie, in spite of its size, is a voracious carnivore. Its first food will include insects such as mayflies and dragonflies but changes to crustaceans and other fish as it approaches adult size.

The black crappie is a favorite of many anglers who prize this sporty fish for its scrappy bout on the end of light tackle as well as its tastiness on the table. Ice fishing is a productive method of harvesting crappies, but early spring fishing using small jigs or minnows is just as successful, if not more so.

White Crappie

Pomoxis annularis

7. Generally speaking, the white crappie is less common over the state than the black crappie. It will, however,

more quickly over-populate a lake, its growth often becoming stunted in the process. The white crappie likes sluggish water, is a frequent resident of lakes and ponds and will seek less-vegetated areas than the black crappie. It is more tolerant of turbidity and siltation than the black crappie. In fact, it will often be found in turbid lakes and in water not quite so cool as that required by the black crappie. Neither crappie is a bottom dweller and shows no particular preference for this physical feature.

The white crappie will grow to be 15 inches or larger, a weight of two pounds or so not uncommon. The sides of the white crappie are silvery olive with shades of olive-green on the back. It will be mottled with dark green to brownish spots which appear mostly on the upper body. These markings tend to form seven or eight vertical bars. The dorsal and caudal fins are marked; the anal fin is pale and nearly unmarked as opposed to the anal fin markings on the black crappie. The dorsal fin is equipped with five or six spines compared to seven or eight on the black crappie. The anal fin has at least five spines.

The spawning habits of the white crappie are much the same as its close cousin. The male guards the nest which has been grouped together with others. The nest will be in water up to eight feet in depth, a bit deeper than other sunfish. Both species of crappies are cyclic in population, abundant for two or three years, then dwindling in numbers for the next two or three. Since the crappie is very prolific, a dominant year-class, that is, the brood of a particular year, will devour much of its own as well as other species. This will go on for several years until other year-classes build up a larger population than the original dominant brood, and the cycle starts all over again.

The white crappie feeds on aquatic insects and plankton while still young and until such time as it is able to prey on fish. As an adult, fish will make up the major part of its diet.

The white crappie also is a favorite quarry of the angler although it is not perceived as being quite as gamey as the black crappie. Still, it is good sport on the rod and good food on the table.

Bluegill

Lepomis macrochirus

8. Not only is the bluegill one of our larger "little fishes", it also is one of the most popular. Common in many lakes, and a favorite in farm ponds, the bluegill might also be found in slower sections of streams. The bluegill prefers much the same habitat as the largemouth bass and very often is associated with this largest member of the sunfish family. He has a particular preference for aquatic weeds in which he can hide and feed. The bluegill usually travels in schools and even maintains this closeness during the spawning period.

The bluegill varies in color more than any other sunfish. It can be a yellow to blue to olive green with some blue and orange overtones. There are six to eight darker vertical bars on the side, and the top of the head is usually a dark greenish. The broad, black gill flap has no red on it. The pectoral fins are long and pointed. A dark spot or blotch usually is present at the base of the rear portion of the dorsal fin.

Spawning time for the bluegill extends over a longer duration than most, occurring between May and August with water temperature the primary factor. A saucer-like depression is fanned out of the sand or gravel, and a large number of these nests are constructed to form colonies. Up to 60,000 eggs may be released into each nest. Protected by the male, they will hatch in two to five days. Many will survive and together can quickly overpopulate a body of water, possibly stunting their growth. Under exceptional conditions, they may grow to be 11 to 12 inches long and weigh up to two pounds, dependent to a large extent on whether or not their population numbers affect their growth rate. A nine-inch bluegill would represent a good average.

Aquatic insects, crustaceans and minnows are the selective foods of the bluegill, although he'll settle for certain plant life when other, more desirable food is not available. He'll move in close to shore from deeper water to feed during the morning and again the evening hours.

The bluegill is probably more of a surface feeder than other sunfish, and therefore is easier to catch by anglers using fly rods. Small popper bugs are deadly. But fly rods are not an absolute necessity, since worms and small grubs will work just as well. There are few of us who have not enjoyed the fun and delight of fishing for bluegills, and many youngsters have been introduced to the sport by way of a tussle with this scrappy fighter.

Redbreast Sunfish

Lepomis auritus

9. The redbreast sunfish is an attractive fish, somewhat resembling the bluegill. On the average, it is one of the larger sunfishes, reaching perhaps 12 inches in length. The redbreast is a sunfish of the larger streams, found primarily with smallmouth bass and rock bass. The redbreast might be found in large riverine impoundments, especially in the Susquehanna River watershed. He prefers shallow water and can tolerate a certain amount of turbidity. He is native to the Delaware and Susquehanna River basins and also is found in the Potomac River drainage. The redbreast has not been observed in the Ohio River watershed, however. Normally a solitary fish during warm weather months, redbreasts will begin to school up as temperatures drop, becoming more or less inactive at about 40 degrees.

The redbreast has a relatively large mouth compared to some other sunnies. The tail is slightly forked, not quite so rounded as other sunfish. The black gill flap, long and flexible, is narrower than the eye and this may be used to help sort this species from the bluegill. There are no spots on the dorsal fin. The body of the redbreast sunfish is yellow on the sides with an orange or dark yellow area located on the belly between the pectoral fins, hence the name redbreast. Sometimes, bluish streaks accent the head area and red spots dot the body.

Spawning activity usually begins when water temperatures have climbed from winter's chill to a springtime 68 degrees. The male fans a nest about 12 inches in diameter out of the gravel where one or more females will deposit their eggs. Unlike the bluegill's large colony of nests, these nests usually are solitary, but again guarded by the male.

A variety of aquatic life, even terrestrial insects, make up the diet of the redbreast. He'll dine on worms, most any insect he is able to catch, and small fish.

The redbreast is a strong fighter and great sport when caught. And, unusual for sunfish, the redbreast is often caught at night. He'll take a variety of lures and live bait. Most who have sampled the meat, rate it with any of the other sunfish.

Green Sunfish

Lepomis cyanellus

10. Although the original range of the green sunfish covered a large part of the central United States, in Pennsylvania it was restricted to sections west of the Appalachians. Now, however, the green sunfish can be found in all major watersheds within the state, but not in large numbers. The green sunfish likes slowly moving water and will often be located in the quiet pools of streams, or in lakes near any shoreline providing adequate cover. He does not wander far from his home territory.

The green sunfish is olive green to brassy with a brassy tint continuing downward toward the belly. The lobe of the gill cover is dark with a light bronze margin. The pectoral fins are short and rounded and the soft portion of the dorsal fin is marked with a black spot at the rear baseline. The mouth of the green sunfish is larger than most, extending beyond the front of the eye. Generally, the body has a short, stocky appearance. Eight inches would be about the maximum size.

Green sunfish spawn over a period of several months Depending on the area, reproduction could occur anytime between June and August. The male will construct several nests which appear in the sand or gravel as a very shallow bowl. He'll guard the eggs, taking over a responsibility inherent in the family. The green sunfish is mature at two years of age at which time it is about three inches in length. Typical of the family, the green sunfish will easily hybridize with other sunfish.

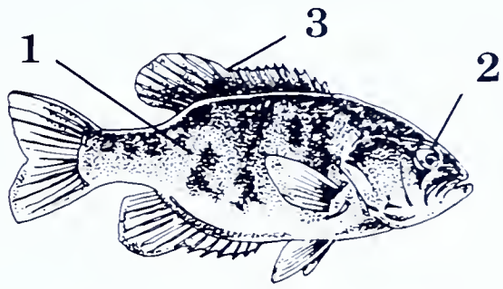
Due to its larger mouth, the green sunfish is able to take food a bit larger than some others of his species. Insects, fish and crayfish are the mainstay of his menu.

Although a smaller panfish than most, the green sunfish can still be fun, especially when caught with light tackle. Even though small, the fillets offer a fine dining experience.

Rock Bass

Ambloplites rupestris

11. Bigmouth, goggle-eye, red-eye — and finally, rock bass; here is a fish of many names. Rock bass being the most commonly used, it is aptly named. Even its scientific Latin name literally means "of the rocks". And the more rocky the area, the happier it is. Although it will sometimes reside in cool, weedy lakes, it most often is found in rivers and moderate-sized streams. It frequently is linked with typical bass habitat. It loves to dwell among the boulders of rocky pools, darting among water plants, old stumps and logs and other extensive cover. The original range of the rock bass in



Rock Bass

1. Brassy to olive in color; can be mottled; dark spot on scales forming rows of dots
2. Red eye
3. Dorsal fin not separated

Pennsylvania was restricted to waters west of the Appalachians. However, it is thought the old canal systems provided it free passage to the watersheds on the eastern slopes, since it now is found statewide.

The body of the rock bass is brassy to olivaceous, with a brownish mottled pattern on each side. The sides also are marked with numerous but interrupted rows or stripes of dots. These dots are formed from a dark spot placed on each scale. There usually is a dark blotch of color — appearing almost as a smudge — on the gill flap. There are five to seven short spines on the anal fin and 11 or 12 of these needle-like rays on the dorsal fin. The body is robust in appearance. The mouth, rather large in comparison to some other sunfish, extends back to the center of the pupil. In Pennsylvania, rock bass of one pound or more are fairly common, especially in larger waters; a length of 12 inches is not unusual.

Spawning will begin when water temperatures rise to the 60- to 70-degree mark. The male readies a solitary nest in May or June which he then vigorously guards. The nest is prepared in shallow water over a gravel or sandy bottom and in moderately swift current. Sunken logs, stumps or large boulders will provide needed shelter for an average of 5,000 eggs.

The rock bass finds its food on or near the bottom where it takes a variety of aquatic insects, crustaceans and small fish. Its larger mouth permits it to take in certain foods bigger in size than most other sunfish are able to handle. It is considered an effective predator along with the smallmouth bass in many of our streams and small rivers.

The rock bass provides many hours of enjoyment for anglers, especially in the spring. They are active feeders and many are taken at night. Although popper bugs are a favorite lure, rock bass can be coaxed into striking a large variety of baits and lures.

Perhaps not quite as popular as other panfish on the table, it nevertheless is good eating, especially when taken from clear water.

Shorthead Redhorse Sucker
Moxostoma macrolepidotum

12. This sucker is fairly common throughout most of Pennsylvania, but appears to be absent from the Delaware River watershed. It favors rivers, but unlike many of the sucker family, will adapt to a lake environment. Warmer temperatures are preferred.

The head of the shorthead redhorse is concave between the eyes. Common to the species, it possesses a toothless, more or less sucker-like protractile mouth surrounded with thick lips. He is a soft-rayed fish as are all suckers. The upper lobe of the tail is narrower and longer than the lower lobe. The shorthead redhorse is bronze to silver along its sides with its back just a shade darker. The tail and lower fins are a bright red. The dorsal fin also has a reddish cast to it, but not of the same brilliance as the lower fins. This sucker may reach 20 to 22 inches if living in good habitat.

Spawning occurs in riffle areas of rivers where the non-adhesive eggs are deposited, only to be left alone. The eggs will be allowed to settle among the stones just a short distance from where the parents normally spend most of their time. The shorthead redhorse sucker may live to be nine years old.

Aquatic insects and snails make a meal for the shorthead redhorse. He also will feast on assorted other organisms as he searches among the stones and underwater plants.

Like the white sucker, the shorthead redhorse is a favorite of spring anglers. Worms are always an effective bait. Although bony, when properly prepared, this sucker can become a tasty treat.

Northern Hog Sucker
Hypentelium nigricans

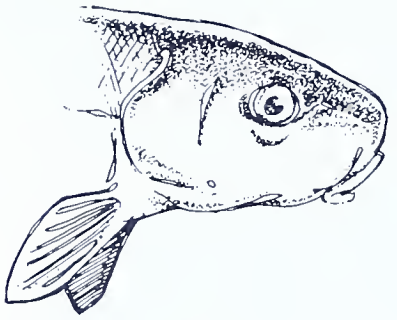
13. The northern hog sucker is common over most of the state west of the Delaware River watershed. It is a stream dweller and particular where it lives. Not tolerant to silt, the northern hog sucker's presence is an indication of clean water. If pollutants should invade its home, it will quickly move out. It will often be seen rooting in riffles which, along with adjacent gravel bottoms, is a favorite haunt. Not being much of a traveler, the northern hog sucker will stick pretty close to home.

A marked indentation of the head between the eyes helps identify this species. The northern hog sucker is a dusky silver, mottled with black across the back which appear as four oblique bars or saddles. This pattern produces a camouflage effect helping conceal him along the stony bottom. The lower fins are a dull red. The body is covered with large scales but the head is scaleless, typical of all the suckers. Twelve to 14 inches is about the maximum size.

The northern hog sucker spawns in the spring as water temperatures climb to about 60 degrees. The eggs are scattered over riffles where they are left unattended. Like most, the northern hog sucker is a prolific spawner.

Foraging in the shallows, it will rest occasionally on the bottom only to quickly dart among the riffles. Dinner is algae and a variety of bottom-dwelling invertebrates. In its habit of rooting or drilling a path through riffles, other food is kicked up in the process, and thus the northern hog sucker indirectly helps feed other fish patiently waiting downstream.

The northern hog sucker is caught only infrequently by anglers and its flesh is not considered as palatable as some others of the sucker family.



Heavy lips surround the typically toothless sucker mouth. The head of the sucker is scaleless.

White Sucker
Catostomus commersoni

14. It is probably safe to say that of the 67 counties in Pennsylvania, not one would be without the white sucker. It is an abundant fish, widespread and the most common of all suckers. A small school of white suckers may sometimes be seen congregated in pools of a stream. It will adjust to a variety of habitats, and although streams are probably its favorite, the white sucker is just at home in a lake or pond. It can adapt to coolwater streams or warmwater lakes. It is not all that finicky about water quality, either. The white sucker can be quite tolerant of poor water and conditions where oxygen content is lower than other species can endure.

The white sucker in Pennsylvania may attain a length of 18 to 24 inches and weigh two to three pounds. Its growth is rapid if proper food is available. The male of the species may be rosy-colored in the spring months, but normally this fish is an olive-brown over the back shading to silvery below.

Early spring brings the annual migration of white suckers up small streams to spawn. Because spawning occurs in May or June, it often is referred to by the nickname "June sucker". These upstream runs take place under cover of darkness as the fish charge up shallow riffles, often with their backs out of the water. The eggs are unloosed by the female to fall into the stony bottom. No care is provided afterwards which is typical of the species. It may live upwards of 12 years.

The white sucker feeds on the bottom, consuming a large variety of animal matter, including zooplankton and aquatic insects. Algae is eaten as well.

The white sucker is pursued by many spring anglers who relish the firm, flaky and very sweet meat. Typical of the suckers, the white sucker is bony, due to some extent, to a set of accessory ribs that extend from the head to the tail. These bones can easily be cooked until softened. Smoking also is a favorite method of preparing the sucker.

Glossary

Definitions included here are as they relate to the study of fish. Although they are, in most cases, defined or clarified at least once in the text, they are included here for easy reference.

Adipose fin. Small, fleshy fin on the back and near the tail of salmon and catfish.

Air (gas, swim) bladder. Sac filled with air (gases) lying beneath the backbone. Regulates buoyancy of a fish and in some (such as the gar) may be a source of oxygen.

Ambient. Surrounding or prevailing.

Anadromous. Fishes living in the ocean (or other large body of water) but which enter freshwater (in the case of lake dwellers, smaller) streams to spawn.

Anal fin. Single fin on underside of fish between the vent and tail.

Barbel. Slender, fleshy projection on the head, usually around the mouth; includes tactile (sensitive to touch) organ.

Basin. An entire area of land drained by a river and its tributaries; can be subdivided into single-tributary areas.

Brackish. Water that is somewhat salty; lies between pure salt water and pure fresh water and is a mixture of both.

Branchiostegal rays. Small, slender bones which support the gill membranes.

Carnivore - Carnivorous. Flesh-eater; feeds on animal tissue.

Cartilaginous. Largely comprised of cartilage, a translucent elastic tissue that may convert to bone.

Catadromous. Fishes living in freshwater streams, but which return to the ocean to spawn.

Caudal fin. Tail of a fish.

Diurnal. Occurring during the day; active during daylight hours.

Dorsal fin. Fin on the back of a fish; may be divided into parts.

Drainage. See *Basin.*

Egg sac (yolk). Membranous sac enclosing food yolk attached to the young fish immediately after hatching and which provides nourishment for several days; fish is referred to as "sac fry" at this stage.

Elver. A juvenile eel.

Estuary. Mouth of a river where its fresh water mixes with salt water and is affected by tides.

Fauna. Animals living in a particular area.

Fingerling. A young fish, older than fry, but usually not more than one year of age.

Fishway. A man-made structure which allows fish to ascend or descend physical barriers such as the breast of a dam.

Fry. Newly hatched fish; usually in various stages of progression: sac fry, swim-up fry, fry, fingerling; length of stages may vary with species.

Gills. Organs through which oxygen is absorbed from the water; protected by gill cover called opercle or operculum.

Heterocercal. Tail structure in which the upper lobe is longer than the lower lobe; backbone turns up and extends into the upper lobe.

Homocercal. Tail structure in which the two lobes are nearly equal in length; backbone ends at base of tail.

Hybrid. Offspring resulting from breeding between parents of two different species.

Indigenous. Occurring naturally; native.

Insectivorous. Feeding on insects.

Invertebrates. Animals without a spinal column (backbone).

Kype. Hooked jaw acquired by trout and salmon, especially at spawning time; it is comprised of cartilage.

Lateral line. Line of scales running lengthwise on each side of a fish with openings or pores connected to a sensory canal.

Mandibular pores. Small openings on the underside of the jaw (mandible) and connected to the sensory canal.

Maxillary. Upper jaw.

Migratory. Move periodically from one area to another to live, spawn or feed.

Noctural. Active during the night.

Omnivorous. Feeding on both animal and plant life.

Pectoral fin. Uppermost fins on either side of the body and usually just behind the gill.

Pelvic fin. Fins on either side of the body, below and often behind the pectoral fins.

pH. Scale of measure of acidity and alkalinity; 7 is neutral, numbers below 7 increasing acidity, above 7 increasing alkalinity.

Piscivorous. Feeding on fishes.

Plankton. Extremely small animals and minute plants that drift passively in the water

Progeny. Offspring; descendant.

Protractile. To be thrust outward or extended.

Ray. Bony structure supporting the membranes of the fin.

Redd. A nest scooped out of gravel, etc. in which eggs are deposited and protected.

Roe. The eggs of a fish; especially when still enclosed in their protective membrane.

Smolt. Juvenile trout or salmon, 1½ - 2 years old as it descends the stream in which it was spawned; and, from which, it enters a larger body of water in which it will live to maturity.

Soft-ray. Flexible, jointed rays supporting a fin.

Spiny-ray. Stiff, hard and unjointed bones supporting a fin.

Swim-up fry. Newly hatched fry in early stage of swimming up for feed after absorption of egg or yolk sac is complete.

Tooth patch. Group of small teeth located on the base of the tongue.

Turbid. Opaque; muddied; caused by suspended matter, usually sediment or the result of rain runoff.

Vertebrate. Animals having a spinal column or backbone.

Vermiculation. Irregular, wavy, worm-like lines.

Watershed. See *Basin.*

Year-class. A group or number of fish of a single species all of which were spawned in the same year; fish of the same brood.

Yolk sac. See *Egg sac.*

Zooplankton. Animal plankton. See *Plankton.*

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American Eel

Smallmouth Bass